072848

Meeting Minutes Transmittal/Approval
Unit Managers' Meeting
Remedial Action and Waste Disposal Unit/Source Operable Unit
3350 George Washington Way, Richland, Washington
April 1999

0051952

FROM/APPROVAL: ______________________ Date 7/22/99
Glenn Goldberg, 100 Area Unit Manager, RL (H0-12)

APPROVAL: ______________________ Date 8/18/99
~~Wayne Soper, 100 Aggregated Area Unit Manager, Ecology (B5-18)~~
Jack Donnelly Cleanup Project Manager (100 & 200 Areas)

APPROVAL: ______________________ Date 7-22-99
Dennis Faulk, 100 Aggregate Area Unit Manager, EPA (B5-01)

APPROVAL: ______________________ Date 8/18/99
Bryan Foley, 200 Area Unit Manager, RL (H0-12)

APPROVAL: N/A See above Date N/A
Joan Bartz/Shri Mohan, 200 Area Aggregate Area Unit Managers, Ecology (B5-18)

APPROVAL: NA See above Date N/A
Ted A. Wooley, 200-B Area Project Manager, Ecology (B5-18)

APPROVAL: ______________________ Date 8-27-99
Robert G. McLeod, 300 Area Unit Manager, RL (H0-12)

APPROVAL: ______________________ Date 8-24-99
Alex Stone, 300 Area Project Manager, WDOE (B5-18)

APPROVAL: ______________________ Date 23 Sep 99
David R. Einan, 300 Area Aggregated Unit Manager, EPA (B5-01)

APPROVAL: N/A Date N/A
Ted A. Wooley, 300 Area Process Trenches Subproject Manager , Ecology (B5-18)

Meeting minutes are attached. Minutes are comprised of the following:

Attachment #1	--	Agendas
Attachment #2	--	Attendance Record
Attachment #3	--	Meeting Minutes
Attachment #4	--	Open Issues from April 20 Meeting
Attachment #5	--	Grain Size Distribution
Attachment #6	--	Cost Estimate for Chromium Remediation at 116-D-7
Attachment #7	--	Draft Test Plan
Attachment #8	--	100 D Group 3 Remedial Action
Attachment #9	--	Revision of the RDR/RAWP for the 100 Area
Attachment #10	--	Hanford Barrier Performance Monitoring and Testing Schedule
Attachment #11	--	RCRA Groundwater Monitoring at the 216-S-10 Pond and Ditch
Attachment #12	--	Background Information of the 200-UP-1 IRM
Attachment #13	--	E-mail from D. R. Einan to R. G. McLeod, 3/25/99

Prepared by: Amy J Jones Date 9/10/99
Amy J. Jones (H0-10)/Tamen Rodriguez (H0-17)

Concurrence by: V. R. Dronen Date 9/30/99
Vern Dronen, BHI Remedial Action and Waste Disposal Project Manager (H0-17)

UNIT MANAGERS MEETING AGENDA

3350 George Washington Way, Room 1B45
April 22, 1999

1:00 – 3:00 p.m. 100 Area 1B45

100 Area Remedial Action

- KE Effluent Pipe Removal
- 105-B and 105-KE Legacy Waste Removal
- Follow-ups/Further Discussions on 116-B-11, 116-C-5, and 116-D-7
- Cr^{6}+ Kd/Leachability Test Plan
- 100-D Group Remedial Action
- Discussion on Summary Level Technical Details
  - Groundwater: Eu152/154/155, Ni63, and Tc99
  - Direct Exposure: PCBs

100 Area Assessment

- Pipelines Evaluation Strategy Discussion
- 100-N RODs Status
- Remaining Sites ROD Status
- Burial Ground FFS Status
- Outfall Structure Status

072848 Attachment 1b

UNIT MANAGERS MEETING AGENDA

3350 George Washington Way, Room 1B45
April 15, 1999

<u>8:00 a. m.</u>. <u>200 Area</u>

- **Overview 200 Area RCRA Groundwater Monitoring (20 minutes)**
  - Status brief on monitoring activities related to S Pond and Ditches
  - M-24 Well Installation for FY99
  - 200-UP-1 Pump and Treat Path Forward

- **200 Area RI/FS Implementation Plan (10 minutes)**
  - Status
  - Approval letter

- **200-CW-1 Gable Mountain/B Pond and Ditches (10 minutes)**
  - Status

- **200-CS-1 Chemical Sewer Waste Group (10 minutes)**
  - Status DQO schedule

- **200-BP-1 Operable Unit (10 minutes)**
  - Monitoring and Testing

UNIT MANAGERS MEETING AGENDA

3350 George Washington Way, Room 2A01
April 15, 1999

10:00 a.m. 300 Area Room 2A01

300 Area Assessment

- 300-FF-2 Status
- Categorization of additional 32 Waste Sites Status
- South Process Pond Remediation Status
- Landfill 1D Lead Contaminated Soils Waiver
- Disposal of Liquid Wastes to ETF
- 618 Burial Ground Drummed Waste Treatment Planning

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 100 Areas
April 15, 1999

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PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE

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Attachment 2b

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 200 Areas
April 15, 1999

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PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
B. L. Foley	DOE-RL	200 Areas	376-7087
Curt Wittreich	ERC	200A Tech	372-9586
Mark Buckmaster	ERC	Groundwater	2-9272
Ron Smith	PNNL	GW Monitoring	376-5831
Bruce Williams	PNNL	G.W. Monitoring	372-3799
Tom Post	EPA	200 Ass	376-6623
Mary Furman	DOE	GW	373-9630
George Henckel	BHI	GW Lead/Head	372-9381
K Michael Thompson	DOE-RL	GW	373-0750
Z. Jackson	Ecology	GW-Hydro Support	336-3024

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 300 Area
April 15, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Tom Post	EPA	300 RPM	376-6623
Bob McLeod	DOE	300 UM	372-0096
Fred Roeck	BHI	Environ Lead	372-9086
Richard Carlson	BHI	300-FF-1 Tech Lead	373-3008
Ella Coenenburg	CHI	300-FF-2	372 9303
Mick Donahue	BHI	FF-2	372-9565
Dave Einan	EPA	300 PM	376-3883
Jeff James	BHI	300-FF-1 TASK LEAD	373-6372

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 100 AREA
April 22, 1999

Attendees: See Attachment #2a.

Agenda: See Attachment #1a.

Topics of Discussion:

100 Area Remedial Action

1. KE Effluent Pipe Removal - Status on pipe cutting and removal has started on April 20, 1999. Much of the pipe will be cut for placement in RCI transport containers. The pipe is 3/8 inch thick steel and is being cut by shears on a backhoe which has worked faster than using a cutting torch.

2. 105-B and 105-KE Legacy Waste Removal - The legacy reactor waste at 105-KE front face has had samples and smears completed for characterization and a waste profile.

   Item 1 Dennis Faulk of EPA asked for a signed copy of the Waste Control Plan supporting the characterization of this work.

   Item 2 Dennis Faulk stated that he had only received a draft of the Legacy Waste Sample Analysis Plan and had not been provided the version 1 copy after receipt of EPA and Ecology comments

3. Follow-ups/Further Discussion on 116-B-11, 116-C-5, and 116-D-7 - A handout was provided summarizing open items from the April 20, 1999 Meeting with EPA, Ecology, DOH and RL (See Attachment #4).

   Item 1, Attachment #4. Draft Meeting Minutes were provided from the April 20, 1999 Meeting (as part of Attachment #4), with request to EPA and Ecology for review and comments so that the Minutes can be finalized.

   Item 2A, Attachment #4. This is in regards to Cr6+ in the deep zone at 116-C5, where all sampling areas had composite values of less than the 2.2ppm soil RAG for protection of the Columbia River. However, the calculated 95%UCL was > 2.2ppm with a log normal distribution. EPA has reviewed internally, and has made a determination that the Remedial Action Objectives (RAO's), RDR/RAWP, DOE/RL-96-17, have been obtained and that no further Remedial Action, closeout verification sampling or analyses will be required, relative to Cr6+ in the deep zone at 116-C5.

   Item 2B, Attachment 4. Other approaches for evaluation of the 95% UCL will be determined on a case by case basis with the lead regulatory agency for the site. In addition, the lead regulatory agency, on a case by case basis, may reduce the UCL limits, as 95% is only guidance from regulatory documentation.

Item 2C, Attachment #4. In regards to the first bullet, for radionuclides, EPA and Ecology concurred that where more than 50% of the sample results are "non-detects," use the MDA for individual "non-detect" sample results was appropriate since radionuclide analytic detection levels (MDA, minimum detectable activity) differ with each individual analysis.

In the case of nonradionuclide analysis detection levels are set at a fixed level (usually determined in the SAP, and implemented in contract requirements). For nonradionuclides, where more than 50% of the sample results are "non-detects", ½ of the detection limit value will be used for individual "non-detect" sample results. The second, third, and fourth bullets were not discussed.

Item 2D, Attachment #4. Issues and resolutions in Item 2, Attachment 4, will require revision to the RDR/RAWP (DOE/RL-96-17 and SAP (DOE/RL-96-22). Revisions to the ROD (EPA, 1996) will not be required.

Item 3A, Attachment #4. EPA and Ecology concurred that allowance for clean backfill can be taken into account during final closeout analyses. However, during remediation, the shallow zone excavation (< 15ft deep) shall still be driven to attain the 15 mrem per year shallow zone RAG, based upon field screening level efforts, such as with the Sodium Iodide (evaluation of gross gamma activity, relative to background), and High Purity Germanium (evaluation of specific gamma radionuclides as tags). Further efforts are still required to develop a testing and analysis process to account for clean backfill.

Item 3B, Attachment #4. EPA and Ecology concurred that decay can be taken into consideration, on a case by case basis, during the final closeout analyses.

Item 3C, Attachment #4. Accounting for grain size bias (conservatively toward fines) in the sampling and testing process was discussed, and a handout provided (See Attachment #5). All acknowledged the conservatism, however further efforts would be required to develop an acceptable approach. This remains an open item for further discussion, review and consideration, including review of previous bench scale tests performed by Serne/PNNL related to this issue.

Item 4A, Attachment #4. The basis for Cr6+ Kd of zero (0) in the RDR/RAWP was discussed. In general, BHI-ERC staff recall that representatives of BHI-ERC, RL, and EPA and Ecology were jointly involved in review of the available background data and resulting decision. However, no specific documentation (Meeting Minutes, Memorandum, etc.) has been found to date, and archive research is still on-going at a low to medium priority at this time.

Item 4B, Attachment #4. A handout was provided summarizing the Rough Order of Magnitude (ROM) Cost and Schedule that would be required for additional vertical excavation and disposal of Cr6+ impacted soils at 116-D7 (See Attachment #6). Estimated cost including ERDF disposal and additional backfill is $580K to $705K. Estimated additional schedule required would be on the order of 1 to 2 months.

Item 5A, Attachment #4. BHI-ERC will provide 116-C5 Calculation Briefs for attainment of RAGs to EPA (lead regulatory agency) within about one week's time, for EPAs review and concurrence to proceed with backfilling at the 116-C5 site. The Calculation Briefs will include some of the issues and resolutions discussed at this UMM (see above). Critical issues for expediting concurrence to backfill include: continuity of the existing

Subcontractor's work (baseline excavation work is completed), availability of earthwork lower tier subcontractors during the proposed start date of mid-June 1999, and backfilling of excavations prior to winter. A meeting will be scheduled for the immediate future by BHI-ERC to present the calculation briefs.

Item 5B, Attachment #4. Same as Item 5A, Attachment #4.

Item 5C, Attachment #4. At this time, Ecology (lead regulatory agency) does not anticipate that additional vertical excavation at the 116-D7 site will be required, the provided ROM cost and schedule estimate being a driver. BHI-ERC indicated that at this time there is baseline remedial action subcontract work ongoing and remaining at the 100D Area Group 2 sites, including pipeline work. Hence, a definitive pathway for the issue of elevated Cr6+ in the deep zone is not critical at this time. All concurred that expediting commencement of the Cr6+ Kd/Leachability test plan would be desirable since results would follow several months after commencement of the test. Invoking of Balancing Factors may be required for this site, and Ecology will consider beginning work on this pathway in parallel with the commencement of the Kd/Leachability test.

4. Cr^{6+} Kd/Leachability Test Plan - BHI-ERC provided written response to comments provided by EPA (and USGS) on the March 17, 1999 Draft Test Plan (see Attachment #7). Ecology reviewed the Draft Test Plan, and had no comments.

EPA indicated that the primary comment and concern was use of the results on a 100 Area wide basis, whereas the samples for this initial test would be from 116-D7. BHI-ERC indicated that a response to this issue was provided in the written response to Comment No. 8, *"The currently proposed test is to be performed on soils from the 116-D7 site at the 100 D Area. Applicability of the results outside of the 116-D7 site and 100 D Area would be determined on a case by case basis by the lead regulatory agency. EPA and Ecology have stated that generally there is a potential for analagous soils approach at three groupings of areas: 100 BC and K Areas; 100 D and H Areas; and 100 F Area."* EPA took no exception to the response, and this verbiage will be incorporated into the Test Plan.

EPA also expressed concern regarding the verbiage related to Kd of zero in the RDR/RAWP, whereas the scientific data covers a range of 1.2 to 1800. BHI-ERC indicated that a response to this issue was provided in the written response to Comment No. 7, including, *" ... At the time the RDR/RAWP was produced ... no Hanford site specific Kd data for Cr(VI) ... expert judgement of several geochemists at Hanford, with concurrence from EPA and Ecology, was that the value could ... be zero ... and ... to use conservative values when adequate site ... values are not available. No published Hanford data exists demonstrating directly or definitively that the Kd value for Cr (VI) in Hanford soils is zero".* EPA took no exception to the response, and this clarification will be made in the test plan text. BHI-ERC, EPA and Ecology will continue to research specific documentation on the basis for usin Kd of zero for Cr6+.

EPA further noted that response to Comment No. 6 was acceptable, and that responses to Comment Nos. 14 and 15 will be discussed off-line with Ecology.

EPA and Ecology concurred that the mechanics of the test plan were generally acceptable, and EPA/Ecology will respond within one week regarding BHI-ERC comment responses, and commencement of the Test Plan.

EPA, Ecology and RL concurred that the Test Plan should be formally finalized with an EPA and Ecology sign off sheet for inclusion in the Administrative Record, and expediting application of the test plan details at other operable units and sites (open item for resolution before next UMM).

5. 100-D Group 3 Remedial Action/Proximity of Existing Burial Grounds - A handout was provided summarizing the issues (see Attachment #8). From discussions with Ecology at the UMM and immediately thereafter, Ecology indicated that flexibility would be allowed where remediating waste sites in close proximity to existing burial grounds. In general, Ecology concurs with the approach to working around the larger 118-D3 Burial Ground where a large degree of uncertainty as to waste form and contaminant concentrations exist. The indicated potholing and GPR campaigns will be helpful in determining waste form and contaminant concentrations for the smaller listed burial grounds, and possibly providing a basis to perform the work within the Group 3 Subcontract. In order for associated burial ground excavation work to be performed in the Group 3 Subcontract, several items would need to be resolved/completed, including: Preliminary Hazard Classfication, ROD inclusion/proximity documentation, Waste Profiling, and basis for Subcontract scope, schedule and pricing.

   In general, Ecology takes no exception to excavating through a burial ground to remediate a waste site or pipeline alignment, and leave the burial ground remaining, where the burial ground encompasses the waste site or pipeline alignment.

6. Discussion on Summary Level Technical Details – The revision of Remedial Action Goals for derived groundwater cleanup concentrations via the National Bureau of Standard/Maximum Permissible Concentration (NBS.MPC [1963]) methodology was discussed. Such a change would require a ROD revision. The remaining sites ROD would be a possible opportunity to revise the cleanup concentration calculation methods.

   Direct Exposure RAGS for PCBs were discussed. Jon Fancher (ERC) provided a handout (Attachment #9) which calculated the shallow zone cleanup value for PCBs based on MTCA guidance. The new value is 0.5 ppm and was approved by all as the appropriate RAG for PCBs.

100 Area Assessment

7. Pipelines Evaluation Strategy Discussion - EPA initiated the discussion saying that most pipelines are associated with waste sites, therefore, remediation of those pipelines would be considered part of the waste site. For the pipelines not associated with waste sites, they would be considered discovery sites and would be candidates for the plug-in approach outlined in the 100 Area Remaining Sites Proposed Plan. EPA's interpretation of the pipelines was consistent with the Pipeline Evaluation Strategy presented at the March UMM. EPA stated they would add language into the 100 Area Remaining Sites ROD that will address pipelines.

8. 100-N RODs Status - RL stated that Ecology and RL are coming to an agreement regarding the waiver issue and that they (i.e. Ecology and RL) are continuing discussions on the institutional control language. ERC commented that work is continuing on addressing the comments from Judy Schwartz (EPA) and that internal review of the changes is scheduled for April 23 with the anticipated RL and regulator review starting May 3.

9. Remaining Sites ROD Status - EPA stated that the draft Remaining Sites ROD should be ready for review by RL and ERC by COB April 27. They requested for a two week review period and that the comments focus on the major issues. EPA also stated there are a few areas in the draft ROD that the reviewers should note. They are:

   - Unlike the 100-Area ROD, this ROD will invoke balancing factors for contamination below 15'.
   - The institutional controls language (proposed for the N RODs) will be used.
   - WAC 173-400 will not be an ARAR.
   - The "Nature and Extent" section will be weak and may need some help.
   - Regarding the standard language of start of remedial work within 15 months, there will be a commitment in the ROD stating that an integration schedule (D&D with RAWP) for the 100 Areas (except for N) will be developed within 12 months.

   Lastly, EPA mentioned that the goal is to obtain signatures on the ROD by June 1 and that the SCAB date for the NRODS is June 30.

10. Burial Ground FFS Status - It was stated that 100 Area Burial Ground Focused Feasibility Study (FFS) will incorporate the new Section 8, which provides the recommended alternative, and will be transmitted to RL within two weeks. RL will then submit the document to the regulators for their formal review.

    On an item not related to the 100 Area, EPA commented that discussions are being held within the EPA office whether the 300-FF-2 FFS should be presented to the National Remedy Review Board in September, along with the 100 Area Burial Ground FFS.

11. Outfall Structure Status - EPA requested that Remedial Action of the near River outfalls (fed from the primary effluent pipelines from the reactors) be included in the Work Scope of ERC's Remedial Action and Waste Disposal Project. BHI took an action item to start the planning, budgeting, and internal coordination within BHI and RL, for this work to be performed in the near future. EPA further requested that remedial action (excavation) be taken to the low water mark for groundwater in the vicinity.

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 200 AREA
April 15, 1999

Attendees: See Attachment #2b.

Agenda: See Attachment #1b.

Topics of Discussion:

1. Overview 200 Area RCRA a groundwater monitoring

   a. *Status Brief on Monitoring Activities Related to S Pond and Ditches* – A handout was reviewed summarizing RCRA groundwater monitoring at the 216-S-10 Pond and Ditch (See Attachment #10).

   b. *M-24 Well Installation for FY99* – DOE has received a final letter from Ecology indicating that one new replacement well should be drilled in 1999 at the 216-S-10 Pond The M-24-00 K interim change form will document regulatory approval of the number and location of RCRA wells to be installed during CY 99, including this well at the 216-S-10 Facility.

   c. *200-UP-1 Pump and Treat Path Forward* – A handout with background information on the 200-UP-1 Pump and Treat System was provided (See Attachment #11). The handout was discussed and Ecology is expected to review the handout and provide comments. The Explanation of Significant Difference (ESD) is currently being prepared and will be submitted to Ecology within a month.

2. 200 Area RI/FS Implementation Plan – The response summary package of public comments for the 200 Area RI/FS Implementation Plan was released on 04/02/99. Rev. 0 of the Implementation Plan is due for DOE concurrence and release during the first week of May, then it will be transmitted to EPA and Ecology. RL is expecting a follow-up approval response letter from EPA and Ecology.

3. 200-CW-1 Gable Mountain/B Pond and Ditches – DOE is in the process of preparing a transmittal letter for 200-CW-1 Draft A RI/FS Work Plan to EPA and Ecology. The Draft A work plan is expected to be transmitted to EPA and Ecology the last week of April meeting TPA Milestone M-13-20.

4. 200-CS-1 Chemical Sewer Waste Group - EPA inquired about what provisions were being made for an enforceable schedule for 200-CS-1 and 200-CW-1. DOE responded that a schedule is already in place and that the DWP is the official documentation for that schedule. A DQO workshop was planned for May 5th.

5. 200-BP-1 Operable Unit – A draft of the treatability test report for the 200-BP-1 OU has been written and submittal to EPA is expected on May 15. A handout showing the possible workscope for continued Hanford Barrier monitoring and testing in FY 99 was provided (See Attachment #12). The content of the handout was discussed and RL requested that EPA review the workscope and provide comments.

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 300 AREA
April 15, 1999

Attendees: See Attachment #2c.

Agenda: See Attachment #1c.

Topics of Discussion:

300-FF-2 Assessment

1. 300-FF-2 Status – The 300-FF-2 focused feasibility study proposed path forward will be presented to DOE today (April 15) at 1 pm. Input from that presentation will be used to prepare for an EPA/DOE briefing on April 21.

2. Categorization of Additional 32 Waste Sites Status – ERC has tentatively set the week of May 10 to meet with DOE and discuss the Categorization of the 32 Additional Waste Sites. EPA is expected to receive the waste site general summary data packages for review by the end of May, but scheduling has not been finalized.

300-FF-1 Remedial Action

3. South Process Pond Remediation Status –There was a discussion of areas of the South Pond which are currently considered clean. EPA/DOE refrained from approval of these areas of the pond until further review of the data. EPA/DOE requested review of survey data for each removed lift to facilitate their decision making process.

   Contaminated soil remained on the southwest slope of the pond after the grubbing layer was removed suggesting that contamination may reach beneath the railroad tracks and operable unit boundary in that area. The remedial design anticipated sheet piling maybe needed to excavate close to the tracks without undermining their structural integrity. EPA and DOE were requested to review the OU boundary definition with respect to the railroad tracks should further contamination be found.

4. Landfill 1D Lead Contaminated Soils Waiver – At this date, EPA is not prepared to approve the waiver for Landfill 1D, but EPA is working with EPA Region X Office and eventual approval is expected. DOE is currently drafting a letter to EPA officially requesting the waiver.

5. Disposal of Liquid Wastes to ETF - EPA has reviewed the request for a variance for disposal of liquid wastes from Landfill 1D to the ETF (See Attachment #13).

6. 618-4 Burial Ground Drummed Waste Treatment Planning – The project is continuing to evaluate the four options in the drum treatment plan. EPA identified a potential technical solution for treating the drummed waste based on discussions with personnel at EPA's research laboratory in Cincinnatti. Tom provided a technical point of contact and some literature on the solidification technology. He suggested evaluating the technology in concert with the other technologies being considered. One potential treatment option is ATG, a local firm. A public meeting was held on April 7 regarding ATG's permitting process. There were only positive comments from the public at the meeting. The permit

is expected to be issued within one month of the public meeting at which time construction of ATG's process equipment is authorized. One factor in considering the future excavation and treatment of the drummed waste is the budgeting process. The current DWP calls for excavation of the drums in Burial Ground 618-4 immediately after excavation of Landfill 1A, early next FY. Drum treatment currently spans two FY years starting in late FY 2000 and finishing in FY 2001. The split FY timing is a budgetary constraint. It was requested that DOE and EPA consider the current assumptions associated with drum excavation and treatment as affects the upcoming DWP planning process.

Attachment 4

Open Issues from April 20 Meeting

1) Draft Meeting Minutes

2) Methods for Processing Data

   A) Case where 95% UCL (lognormal distribution) is greater than maximum detected (e.g., 116-C-5). Use of the maximum or mean concentration in deep zone in lieu of the 95% UCL.

   B) Use of other approaches and methods for calculating 95% UCL (e.g., "Marssim"/ non-parametric)

   C) Detailed Methods

      - Use of the non-detect values in cases where 50% or greater of the sample results are non-detects, instead of automatically using the maximum detected.
      - Default to normal distribution when data set is small.
      - If data set is large and (-) or zero values are reported, default to normal.
      - If data set is large and distribution is non-parametric, default to normal.

   D) Impact (if any) of potential changes on controlling documents (e.g., ROD, RDR/RAWP, SAP, etc..)

3) Site Specific Issues

   A) Accounting for clean backfill to better represent actual site conditions.

   B) Accounting for decay when final analysis shows the site exceeding dose rate limits.

   C) Accounting for grain size bias.

4) General Inquiries from 4/20 Meeting

   A) Basis for Cr(VI) Kd of 0.

   B) Rough order of magnitude cost for D7 excavation option.

5) Paths Forward

   A) 116-C-5

   B) 116-B-11

   C) 116-D-7

6) Hexavalent Chromium Test Plan

   A) Comment Response Discussions

Draft Meeting Minutes from April 20 Meeting

Subject: 100 Area Remedial Action Update (116-C-5, 116-B-11, and 116-D-7)

A meeting on the above subject was held on April 20, 1999, at 3350 George Washington Way, Richland, WA. In attendance were Project and Operable Unit Managers from the US Department of Energy, Richland Operations Office (RL), Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), the Washington State Department of Health (DOH), and Environmental Restoration Contractor (ERC) staff.

The purpose of the meeting was to present status of cleanup and verification activities, discuss potential problems, associated options, and paths forward.

FOLLOWING IS A SUMMARY OF KEY TOPICS DISCUSSED, AND KEY DECISIONS/CONCLUSIONS MADE.

It was agreed that open ("parking lot") items would be further discussed at the April 22, 1999 100 Area Unit Manager's Meeting, and following internal discussion at respective organizations. It was agreed that a consistent approach was needed between EPA and Ecology lead sites. See handouts (attached) for background and details of information provided:

116-C-5 (EPA as Lead Agency)

1. Use of the 116-C-1 vadose zone test pit data trend to develop the 116-C-5 contaminant profile distribution with depth, was discussed and presented.

   No exceptions were noted on the approach. EPA requested that the associated calculation brief and cleanup verification package describe, and use to the extent possible, Dorian and Richards data in the evaluations. It was noted that the Dorian and Richards data for 116-C-5 was generally consistent with the more conservative distribution trend using the 116-C-1 test pit data.

2. The shallow zone/direct exposure results were presented and discussed. Shallow Zone, cleanup verification side wall samples were taken in January 1999, and backfilling is tentatively planned for June 1999. Allowing for radionuclide decay up to June 1999, but not accounting for clean backfill or overburden in the analysis, results in attaining direct exposure RAGs.

   There was discussion on considering:

   A. Accounting for the use of clean backfill/set aside overburden.
   B. In cases where 50% or greater of the results are non-detects, include the non-detect method detection limit values in the 95%UCL calculation instead of automatically using the maximum detected.

DRAFT

C. Use of other approaches and methods to determine the 95% UCL (e.g., "Marssim"/non-parametric, or other approaches not included in MTCA guidance).
D. Allowing the use decay in the analyses for attainment of RAGs for radionuclide COCs.

The above items remain open for further discussion.

3. A plot plan of the 116-C-5 deep zone cleanup verification sampling grid was presented, which included current Cr6+ close out composite results for all sample areas and the original results (>2.2 mg/kg River protection limit) from the areas that were excavated to remediate the Cr6+. Although all composite results were less than 2.0 ppm, the 95% UCL of the log normal distributed data is 2.28 ppm.

   There was discussion on considering:

   A. Use of the maximum or mean concentration value, in lieu of the 95% UCL value.
   B. Use of Marssim/non-parametric, and/or other approaches for determining 95%UCL.
   C. Related to Cr6+ concentrations at depth, attainment of a statistical value of 2.2 ppm Cr6+ at the surface of the deep zone would be adequate, with no further vadose zone modeling or analysis at depth required for Cr6+.

   The above items remain open for further discussion.

4. A target date of next Tuesday April 27, 1999 for delivery of cleanup verification calculation briefs to EPA, with a turnaround date of Tuesday May 4, 1999 for concurrence to proceed backfilling was discussed (at this time, either 116-C-5 or 116-B-11 are candidates). EPA agreed with the proposed turnaround time. It was agreed that a consistent approach was needed between EPA and Ecology lead sites.

116-B-11 (EPA as Lead Agency)

1. Similar to 116-C-5, the 116-C-1 vadose zone test pit data trend to develop the 116-B-11 contaminant profile distribution with depth, was discussed and presented.

   No exceptions were noted on the approach. EPA requested that the associated calculation brief and cleanup verification package describe that Dorian and Richards data was evaluated and screened for use. It was described that the Dorian and Richards data for 116-C-5 fell within the generally more conservative distribution trend using the 116-C-1 test pit data.

2. The shallow zone/direct exposure results were presented and discussed. Allowing for radionuclide decay up to 3 years, but not accounting for clean backfill or overburden in the analysis, results in attaining direct exposure RAGs.

   There was discussion on considering:

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A. Accounting for the use of clean backfill/set aside overburden.
B. In cases where 50% or greater of the results are non-detects, include the non-detect method detection limit values in the 95%UCL calculation instead of automatically using the maximum detected.
C. Use of other approaches and methods to determine the 95% UCL (e.g., "Marssim"/non-parametric, or other approaches not included in MTCA guidance).
D. Allowing the use decay in the analyses for attainment of RAGs for radionuclide COCs.

The above items remain open for further discussion.

116-D-7 (Ecology as Lead Agency)

1. Use of Dorian and Richards Data to Define Deep Zone Model. The general concept of using Dorian and Richards data to define the deep zone model was acceptable to Ecology. A calculation brief is being prepared and will be made available to Ecology for review in the near future.

2. Cleanup Verification Statistical Methods. The same discussion noted above for C5 and B11 applies to D7.

3. The only remaining cleanup verification issue is the elevated Cr6+ concentrations at the base of the excavation, and underlying the excavation, as observed in recently made exploration pits (potholing). Based upon the potholing results, trend of the Cr6+ data indicates concentrations above 2.2 ppm at the surface extending to depths of about 4 meters, where concentrations appear to taper below 2.2 ppm, based upon limited data.

   Options discussed included:

   A. Additional excavation until RAGs attained.
   B. Initiate Kd/Leachability Test Plan
   C. In Situ Treatment/Engineering Controls
   D. Land Use/exposure scenario revision, and initiating in parallel with Kd/Leachability testing.

   The above items remain open for further discussion.

4. EPA-USGS comments and ERC responses on the Kd-Leachability Test Plan were briefly discussed.

   A. In regards to General Comment No. 1, a pilot-field scale, or bench scale testing is not required.
   B. EPA's primary concern is that the test plan states the results would be applicable 100 Area wide. It is acknowledged that the test plan and samples are from 116-D-

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7 and applicability of the results outside of the 116-D-7 site and 100D Area would be determined on a case by case basis by the lead regulatory agency. EPA and Ecology stated that generally there is potential for analogous soils approach at three groupings of areas: 100 BC and K Areas; 100 D and H Areas; and 100 F Area.

C. EPA also expressed a concern that if all published data points to Kd results for Cr6+ being greater than zero, and the RDR/RAWP recommends a value of zero, then this point needs to be reevaluated.

D. Other than above primary concerns, there were no fatal flaws in the test plan. Comment resolution will be in the near term so that the test plan can get implemented. Target will be to have ERC responses by the Thursday 4-22-99 UMM, with advance copies distributed beforehand.

5. Use of H2S was discussed and was generally considered to be not viable due to the size of the effected area, and previous discussions with PNNL technology staff. EPA did note however, that EM-50 should be advised of the situation and asked to look at other technology funded solutions.

6. Ecology requested a rough order of magnitude cost estimate for the excavation alternative.

7. Sample Bias Grain Size. All attendees agreed that the cleanup verification sampling was probably biased toward the finer grained materials. This bias leads to over-conservative results where there are larger size fractions that represent the majority of the volume and weight, but are not analyzed due to the particle size limitations in the laboratory. All agreed that this issue should be evaluated further, and remains an open item for further discussion.

The following summarizes action items:

1. ALL - Discuss open items further at the 4-22-99 UMM and discuss internally at respective organizations beforehand.

2. ERC - Research basis for use of Kd of zero for Cr6+, and whether or not published data exists for Kd of zero.

3. ERC - Determine a rough order of magnitude cost estimate for the 116-D-7 excavation alternative for remediation of Cr6+ in the deep zone, to depths where Cr6+ is below 2.2ppm based upon the existing potholing data.

4. ALL - Research ROD requirements, or other Project documentation pertaining to data processing and statistical calculation methodologies.

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Grain Size Distribution

- Per soil washing report, 80% of contamination is found in 20% of soil (by weight)

- Option 1: Assume D-Area soil wash results apply to 116-D-7.

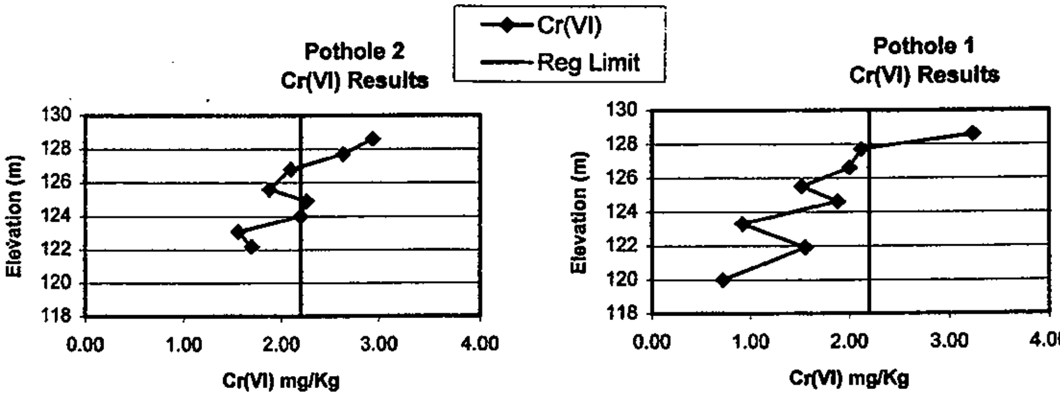
  1. Assume current samples approximate the size fraction that is 20% by weight of the total.
  2. Multiply the current 95% UCL result by 20/80 to represent the total concentration.
  3. 3.3 mg/kg x 20/80 = 0.825 mg/kg

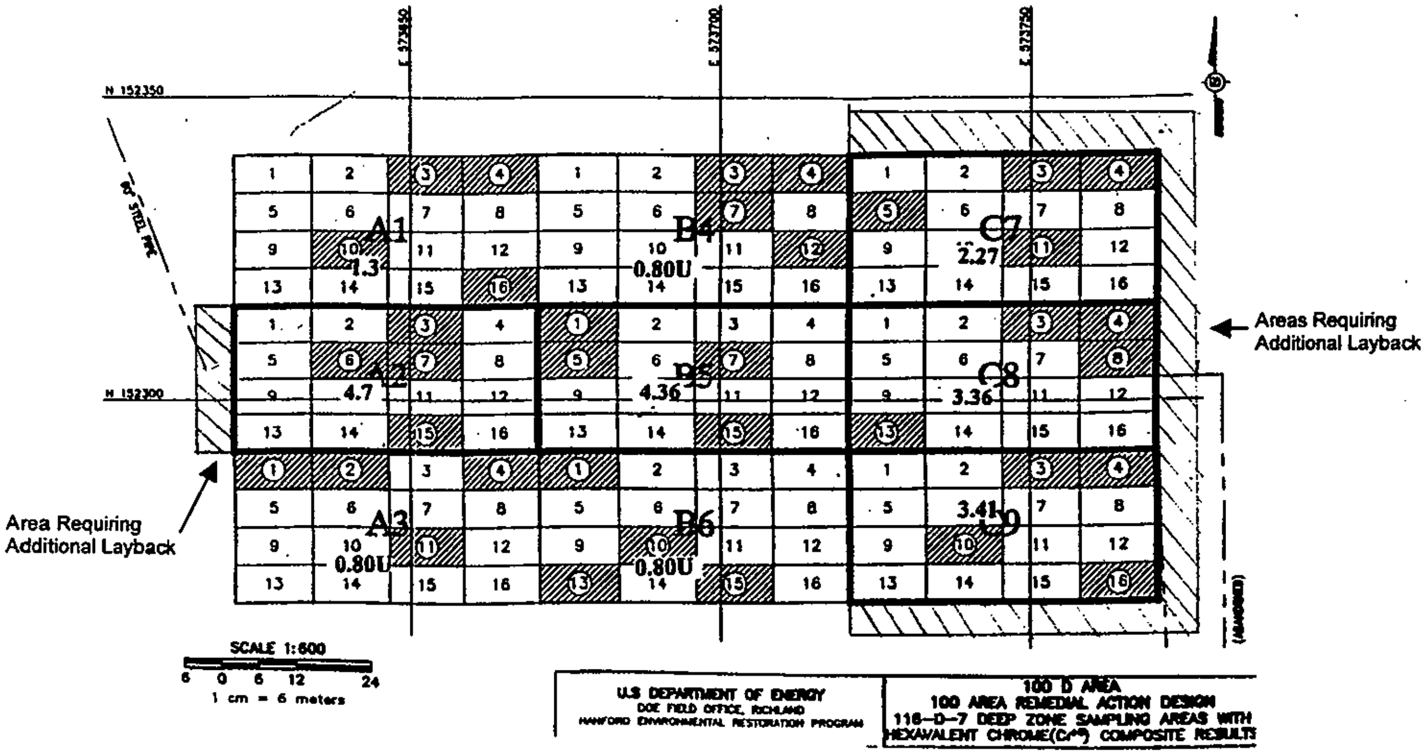
- Option 2: Site Specific Testing

  1. Perform grain size analysis on 116-D-7 soils
  2. Determine size fraction of finer materials that is equivalent to 20% of weight
  3. Run Cr(VI) analysis on "20% by weight" size fraction sample
  4. Multiply result by 20/80 to calculate total concentration

ROUGH ORDER OF MAGNITUDE COST ESTIMATE
ADDITIONAL HEXAVALENT CHROMIUM (Cr+6) REMEDIATON AT 116-D7

Pothole 2 (B5 Area), required excavation depth of ~ 1m, Pothole 1 (C8 Area), required excavation depth of 4.6m to attain Soil RAG of 2.2ppm for River Protection. Average excavation depth from this data is 2.8m.





Average additional excavation of 2.8m, extending to a maximum of 4.6m in some areas, at the five sampling areas, including additional layback for safety purposes. Total excavation depth would be about 24ft average and 27 feet maximum. Additional ERDF Disposal Cost and Additional Subcontract Backfilling costs are also included below:

Additional Excavation Subcontract Cost = *Subcontract additional duration of 1 to 2 months.*	***$260K to $380K***
Additional ERDF Disposal Cost =	***$310K***
Additional Subcontract Backfilling Costs =	***$ 10K to $ 15K***
Estimated Cost	***$580K to $705K***

Comment/Response

For The

March 17, 1999 DRAFT

Test Plan for the Determination of Distribution Coefficient and Leachability of Hexavalent Chromium in 100 Area Hanford Formation Soils.

Reviewers:

U.S. Environmental Protection Agency (EPA)
Washington State Department of Ecology (Ecology)
United States Geological Service (USGS)

General Comments:

1. Given attention to specific comments raised as part of the review of this document, the laboratory procedures, as described herein, should accommodate the needs of the study and provide the data needed to design worthwhile pilot/field-scale experimentation. However, better attention should be paid toward understanding the intrinsic properties of soils and, therefore, devising the means to sample and undertake bench-scale experimentation that will produce results that most likely will be transferable to a field setting.

Response: **Noted**: Understanding the mechanisms and subtleties of the chromium distribution would be nice to know, and an appropriate academic exercise as opposed to this test which is intended to get working values for a specific site, regardless of the mechanisms. Working with limited budget and schedule considerations, there will be no change to expand the scope of this test. The values resulting from this bench scale work will be directly applicable to RESRAD calculations as presented. RL, EPA and Ecology concur that pilot/field–scale experimentation is not necessary. No change in text or test plan will be made.

Specific comments:

1. **Page 1, Section 1.1, paragraph 1, sentence 2**: The statement is true regarding soil solution, but does not account for primary and secondary mineral forms, let alone insoluble/immobile complexes.

Response: **Partial Accept:** The test plan shall be revised to read, "Hexavalent chromium is typically present in soil pore water as chromate ion $HCrO_4^-$ (soil pH

<6.5) or CrO_4^{2-} (soil pH ≥6.5), or as dichromate ion $Cr_2O_7^{2-}$ (soil pH ≥6.5) at higher concentrations (EPA 1992)." It is difficult, and perhaps impossible, to measure the speciation of Cr on the sediments directly. We have attempted to distinguish Cr(VI) from Cr(III), or more correctly total Cr by using SW-846 extraction procedures. Results suggest that there is measurable Cr(VI) in the sediments as shown in the following table.

Sample Sub unit	HEIS Number	Cr+6 (mg/Kg)	Total Cr (mg/Kg)
A1	B0PK25	1.3	117
A2	B0PK19	2.9	153
A3	B0PK24	0.80U	144
B4	B0PK17	0.80U	226
B5	B0PK23	8.5	339
B6	B0PK21	0.80U	131
C7	B0PK26	1.4	117
C7 Dup	B0PK27	3.0	142
C7 Split	B0PK16	5.89	209
C8	B0PK20	18.0	152
C9	B0PK18	3.8	90.9

It is the fate of this Cr(VI) that is the focus of our investigation. Change to text will be made as noted above.

2. **p. 1, 1.1, para. 1, sentence 3:** Again, there is a distinction between bulk soil-chemistry and soil-solution chemistry.

Response: **Noted:** The text in the test plan does not consider the Cr speciation on the solids but does address current understanding of how solution borne Cr(VI) would interact with sediment surfaces from an adsorption perspective. We did not include solubility processes in the discussion because we felt that the current pore waters would not contain enough Cr(VI) to initiate precipitation of a pure Cr(VI) compound. The science of co-precipitation is often conceptualized and modeled as adsorption so even if the Cr(VI) is involved in co-precipitation with other analytes it can be discussed and modeled as a sorption process. No change in text or test plan will be made.

3. **p. 1, 1.1, para. 1, sentence 7:** If clay is a significant component of soil (especially compared to organic matter), then clay (depending on type) may effectively control chromium mobility.

Response: **Noted:** We do not disagree with this statement. However some of the soils used by Korte et al. (1976) had clay contents higher than the Hanford formation sediments, especially the coarse grained sediments near the Columbia River. The test plan was only reviewing information of others findings and as written Korte did not find clay content to be a significant variable in his studies. We did not infer anything from Korte's data explicitly but do feel it does apply to the coarse-grained Hanford sediments also. No change in text or test plan will be made.

4. **p. 1, 1.1, para. 1, sentence 8:** Reducing conditions are needed for this to be a factor -- which is unlikely in unsaturated soils with low organic-matter content.

Response: **Noted:** We agree, and did not mean to infer in the literature review section that we expected organic matter to play a reducing role in the contaminated Hanford sediments at the 100-Areas. No change in text or test plan will be made.

5. **p. 1, 1.1, para. 2, sentence 1:** The definition for Kd is unclear.

Response: **Accept:** The following wording will be added: "The ratio is calculated using the concentration of contaminant bound to the solid (per gram of solid) divided by the concentration of contaminant in solution (per milliliter of liquid)."

6. **p. 2, 1.1, para. 2, sentence 4:** "Vadose soil" is not correct terminology.

Response: **Noted:** Comment needs clarification. Are you saying that we should call the unsaturated solids at Hanford sediments as opposed to soils, which have a distinction from sediments in the eyes of agricultural scientists and engineers? We agree but the interchangeability of the term soil and sediment is very common in waste management terminology. We trust that this comment is editorial in nature, and does not preclude viability and commencement of the test plan. No change in text or test plan will be made.

7. **p. 2, 1.1, para. 6, sentence 1:** The text indicates that data only exist for Kd values from 1.2 to 1800, however a Kd value of zero was selected in the RD/RA Work Plan. It is understood that the value of zero was selected based on previous Hanford data or other published data. Please provide clarification to this statement.

Response: **Accept:** Yes the text is confusing and was the observation of one author's literature review. It should not be construed as meaning that the use of a Kd of zero was "wrong". At the time the RD/RA was produced there was no Hanford site specific Kd data for Cr(VI) but the expert judgement of several geochemists at Hanford, with concurrence from EPA and Ecology, was that the value could quite possibly be zero and the traditional risk approach is to use conservative values when adequate site and scenario values are not available. No published Hanford data exists demonstrating directly and definitively that the Kd value for

Cr(VI) in Hanford soils is zero. The text will be revised reflecting this clarification.

8. **p. 3, 1.1, para. 6, sentence 5:** This sentence and the last sentence in Section 1.0 imply variation in 100 area soils that necessitate that Kd values must be determined site-by-site. Clarify these statements.

Response: **Accept:** The key point we are trying to make is that the quantification of the mobility of Cr(VI) or Cr total at the Hanford Reservation is problematical. That is, predictions of its fate and known groundwater plumes suggest that it is potentially mobile and potentially a risk driver. The use of non-specific or generic Kd values to perform the fate/transport calculations is unsatisfactory when there is a clear indication that there may be real risk. In such instances, the best technical approach is to gather site-specific and scenario relevant data. That is exactly what we are proposing to do. Actual data on the sorption (Kd) and leachability of Cr from the 100-Area sediments will bolster the technical credibility of any future predictions of long-term fate and allow more technically sound decisions to be made.

The currently proposed test is to be performed on soils from the 116-D7 site at the 100 D Area. Applicability of the results outside of the 116-D7 site and 100 D Area would be determined on a case by case basis by the lead regulatory agency. EPA and Ecology have stated that generally there is a potential for analogous soils approach at three groupings of areas: 100 BC and K Areas; 100 D and H Areas; and 100 F Area.

The text will be revised reflecting clarification in the above paragraph.

9. **p. 2, 1.1, para. 3, sentence 1:** Soils exist to a depth of 4-6 feet, below which the material should be referred to as underlying sediments.

Response: **Accept:** The depth at which soils exist is dependent on weathering environments, parent material, climate and other factors. At Hanford 100-Area one can argue that there is no "soil" developed at the surface because of the past catastrophic floods. We will change the wording throughout the test plan to use the more technically accurate term sediment.

10. **p. 2, 1.1, para. 3, sentence 2:** What is the textural composition of the soils that formed on Hanford Formation sediments?

Response: **Noted:** If there was a true soil layer at 100-Areas it has been disturbed and mixed with the sediments. The Hanford sediment along the Columbia River in the 100-Areas are quite coarse; predominately gravels with as little as 20%-40% sand, silt, and clay. No change in text or test plan will be made.

11. **p. 3, 1.2, point 1:** There most likely will be some variance, as both the soils and concentrations of chromium and species of chromium vary. Therefore, a mean Kd could be determined with associated standard deviation.

Response: **Noted:** p. 3, last paragraph, third sentence states the average (mean) value will be reported. The test plan calls for selecting a representative clean sediment and sieving it through #4 mesh [4.76 mm] for use in some preliminary batch adsorption experiments using Hanford groundwater spiked with three different starting concentrations of Cr(VI) as chromate. If the preliminary results suggest that there is very little sorption [Kd < 0.5 ml/g], then no further sorption testing will be performed. The rest of the testing will be leach testing of a representative contaminated sediment.

While it is true that the total and Cr(VI) extractable concentrations vary with location and depth in the contaminated 100-Area sediments, we believe at present that the Cr sources and reactions with the sediments are similar enough that testing on one representative sediment will be adequate to gain valuable and useful data for making decisions. No change in text or test plan will be made.

12. **p. 3, 1.2, point 2, para. 1:** The conversion of hexavalent chromium to the trivalent form is unlikely, unless it's because the soils are saturated for a period of time -- therefore, this effort may be unproductive.

Response: **Noted:** Although the comment has merit, stating that conversion does or does not take place without some form of evidence, either way, is inconclusive. In addition to the mass balance, this analysis will also add value by giving an idea of the variability of the soils being tested. The total and hexavalent analyses on the water samples may also help address any anomalies encountered in the data. No change in text or test plan will be made.

13. **p. 4, 1.2, point 2, para. 3, sentence 6:** Column tests are generally run under saturated conditions, which do not represent the soils as they naturally occur. Such conditions will have a large impact on the solubility and mobility of a variety of constituents, including chromium.

Response: **Noted:** We elected to perform a saturated column study to reduce the time necessary to gather data and the costs of performing the test. The fact that we will be using saturated conditions should leach more Cr from the contaminated sediment than might occur under vadose zone conditions and thus our leach rate data may be conservative (i. e., overestimate Cr leaching). No change in text or test plan will be made.

14. **p. 5, 2.1.1, sentence 3:** One would be hard pressed to conclude any reliable Kd value during such a screening process.

Response: **Noted:** We disagree. Although we did omit the details, the screening batch adsorption test will use techniques that have been performed at Hanford and passed peer review for over 20 years. The method Relyea, J. F., R. J. Serne and D. Rai. 1980. Methods for Determining Radionuclide Retardation Factors: Status Report. PNL-3349, Richland, Washington was the template used by ASTM to form their standard D 4319 "Standard Test Method for Distribution Ratios by the Short-term Batch Method" promulgated in 1983 and re-approved in 1990. No change in text or test plan will be made.

15. **p. 5, 2.1.2, first bullet:** Generally, this analysis would be performed on oven-dried material.

Response: **Noted:** We disagree. With Hanford sediments we have found that oven drying and then wet sieving can lead to an underestimation of the silt and clay fraction probably because some of the fine get baked onto the sands. The difference is less than that found by dry sieving, however. We prefer to use field moisture content material that has been well mixed by cone and quartering and then taking an aliquot (for this testing three for moisture content) and then proceeding directly to wet sieving. All data is reported on an oven dry basis. No change in text or test plan will be made.

16. **p. 5, 2.1.2, second bullet:** This is typically done on whole soil or soil sieved in the field.

Response: **Accept:** An as received moisture content will be taken on the coarse material before sieving and then after sieving and differences will be reported. We have found in the past that if the sieving is performed rapidly that there is very little change in the moisture content that is not accounted for by removing "dry" boulders from the mix. A change in text and test plan will be made accordingly.

17. **p. 5, 2.1.2, third, fourth, fifth, sixth bullets:** The times should be considerably longer. A good reference for this type of work is "Soil Characterization Laboratory Procedures Manual," by Falen and Fosberg, available through the University of Idaho Agricultural Experiment Station.

Response: **Partial Accept:** We will use the recommendations from **"Methods of Soil Analysis Part 3—Chemical Methods "**. It is published by the Soil Science Society of America and American Society of Agronomy, Inc. Madison, Wisconsin. They recommend one-hour contact times. Appropriate changes to the text will be made (contact times revised from ½ to one hour).

18. **p. 5, 2.1.2, seventh, eighth bullets:** What methods will be used?

Response: **Noted:** The methods are shown in Table 4 later in the test plan. They are EPA SW-846 procedures. No change in text or test plan will be made.

19. **p. 6, 2.1.2, para. 3, sentence 3**: Why use groundwater on soils? They are unlikely to ever have interaction.

Response: **Noted:** Groundwater was chosen because it has a similar composition to vadose zone pore water as determined by saturation extracts and 1:1 water extracts. See Serne, R. J. et al, 1993. Solid-Waste Leach Characteristics and Contaminant-Sediment Interactions. Vol. 1: Batch Leach and Adsorption Tests and Sediment Characterization, PNL-8889, Pacific Northwest Laboratory, Richland, Washington, and Serne, R. J. and M. I. Wood. 1990. Hanford Waste-Form Release and Sediment Interaction: A Status Report with Rationale and Recommendations for Additional Studies, PNL-7297, Pacific Northwest Laboratory, Richland, Washington . for details. We do not want the bulk composition of the water phase to change when contacting the sediments because then reaching equilibrium takes a long time. The whole purpose of determining the Kd values desires that the system be at equilibrium. All we want to measure is the change in the Cr(VI) that is added to the solution when contacting Hanford sediment. We are trying to isolate the adsorption reaction from other extraneous reactions. No change in text or test plan will be made.

20. **p. 6, 2.1.2, para. 3, fourth bullet:** ORP is commonly referred to as Eh

Response: **Noted:** We will continue to use ORP (oxidation reduction potential). No change in text or test plan will be made.

21. **p. 6, 2.1.2, para. 4, sentence 3:** Are you referring to solids or bulk chemistry, and which analytical methods?

Response: **Noted:** As a clarification, the test plan states that the Cr(VI) and total Cr would be measured at the end of the test on the final solution only. A mass balance will be used to determine the final soil concentration. Methods are in table 4 for water. No change in text or test plan will be made.

22. **p. 6, 2.1.1, para. 1, sentence 1:** Remember--this is a dynamic "equilibrium".

Response: **Noted:** No change in text or test plan will be made.

23. **p. 8, table 1:** See previous comments about these.

Response: **Noted:** See response to comment 17. No change in text or test plan will be made.

24. **p. 8, 2.1.4, para. 1, sentence 2:** Why 30%?

Response: **Noted:** Past history on working with Hanford sediments show that 30% is an achievable yet adequately challenging goal. Setting the criteria more stringently only leads to the expenditure of more money with no better end results on the value of the data. In other words the natural variability of many of these parameters in sediments is very close to 30% and the analytical labs can not be held to produce data more precise than natural heterogeneity. No change in text or test plan will be made.

25. **p. 10, 2.2.1, para. 2, sentence 2:** Is the site irrigated?

Response: **Noted:** No the site is not currently irrigated. The irrigation scenario is one scenario that must be assessed for the future land use in fate and risk calculations. Thus to be protective in future risk calculations the amount of water expected during irrigation was chosen as the test condition to be used. No change in text or test plan will be made.

26. **p. 10, 2.2.1, para. 2, sentence 3:** This test may take awhile.

Response: **Noted:** The column will be contacted with the volume of water expected to be present in one year [914 mm (36 in.) of water that represents rainfall (6 in.) plus irrigation (30 in.)]. To get results in a more timely fashion the flow rate will be selected to be 10 times this rate such that 914 mm of water can be collected in 40 days instead of one year. Given the dimensions of the proposed column the residence time for a pore volume of water will be 4 days, which is long enough to expect minimal kinetic effects for the leaching of slightly soluble Cr (VI) salts. The column test will continue until leaching is no longer occurring or a years worth of solution has exited the column [based on the column dimensions 9.75 pore volumes will be collected in 40 days]. No change in text or test plan will be made.

27. **p. 11, bullets:** See previous comments about these.

Response: **Noted:** See response to comment 17. No change in text or test plan will be made.

28. **p. 13, 3.0, para. 1, sentence 2:** These are too deep to be considered a "soil".

Response: **Accept:** See response #9.

29. **p. 13, 3.0, para. 2:** But it is not the chemistry of the water that may leach contaminants of concern from the soil.

Response: **Noted:** See comment # 19. Further rainwater quickly equilibrates with the arid Hanford sediments and takes on the chemical nature of the pore water and thus the groundwater. No change in text or test plan will be made.

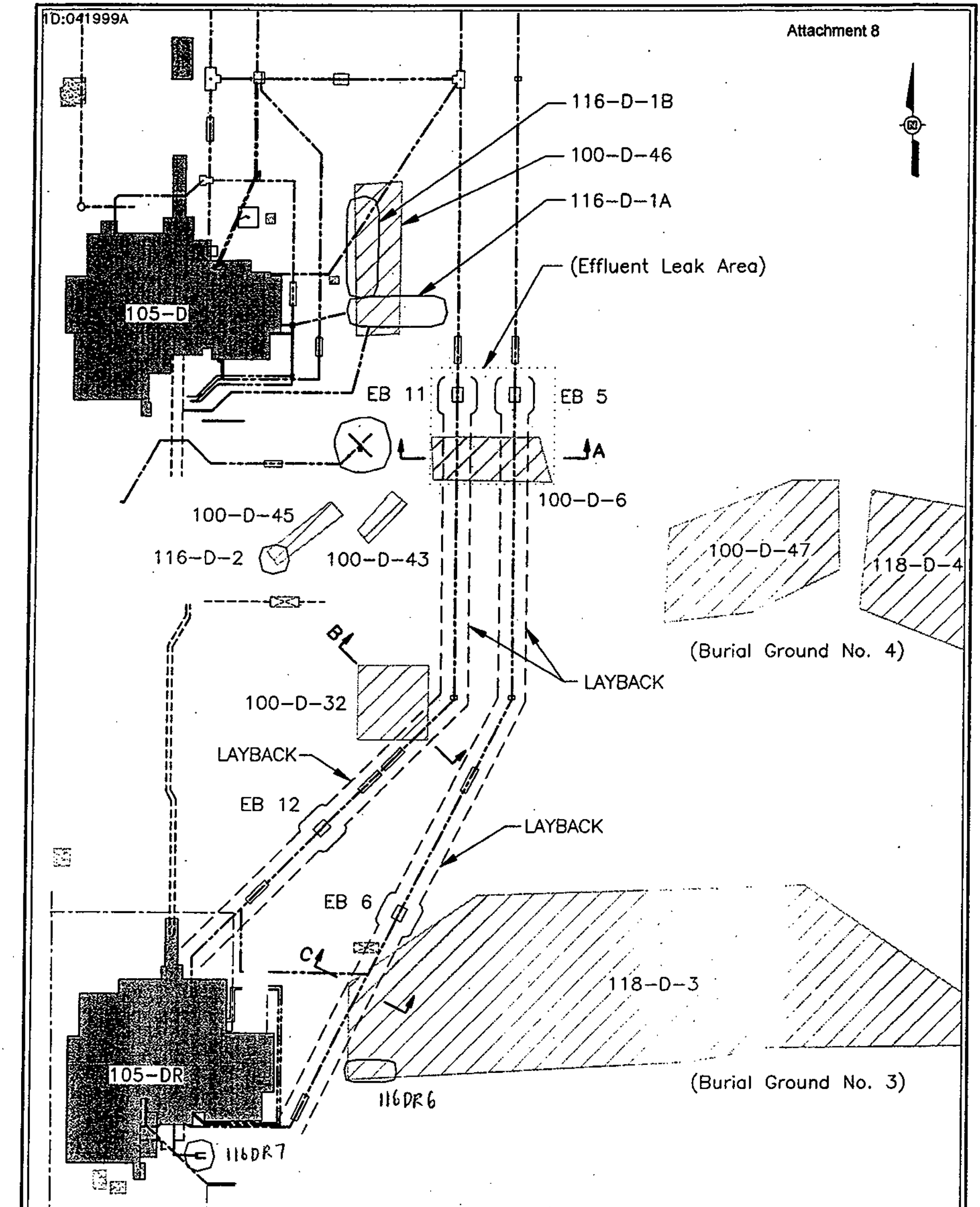
30. **p. 13, 3.1, para. 1, sentence 1:** How is this done when little, if any, knowledge exists on soils at Hanford? Perhaps a random design could be used. However, if enough information exists to be able to distinguish different soil series within the study area then, perhaps, a stratified sampling design should be used to incorporate the variability into the sampling.

Response: **Noted:** The intent of this statement is to let the sampler know we are after "typical" material found at the site being sampled as opposed to the occasional sandy lens or boulder field that have been encountered in the past. There is much knowledge and data available on the Hanford formation sediments. There have also been field investigations in the 100-Areas to ascertain the distribution of total and Cr(VI). It is the Cr issue that drives this plan. While it is true that the total and Cr(VI) extractable concentrations may vary with location and depth in the contaminated 100-Area sediments, we believe at present that the Cr sources and reactions with the sediments are similar enough that testing on one representative sediment will be adequate to gain valuable and useful data for making decisions. No change in text or test plan will be made.

100 D GROUP 3 REMEDIAL ACTION
NEAR REACTOR SMALL SITES AND EFFLUENT PIPELINE

- Remedial Action tentatively to start circa Oct 1, 1999, or slightly earlier.
- Near the Reactor(s) area, several effluent pipeline segments, and some waste sites are in close proximity, or occupying same area as listed burial grounds.
    - Available information is uncertain and/or inconsistent and not reliable for final design, planning, subcontracting and budgeting purposes.
    - A GPR campaign is planned to start immediately in these areas, followed by a "pothole" and/or trenching investigation campaign at the start of the remediation.
    - At this time, there is no evidence, including recent data, indicating that the actual landfill footprints for 118-D3 and 100 D46, are within the 116-DR6, or 116-D1A/B waste site footprints, respectively. However, pothole exploration is planned prior to excavation.
    - Questions/Input from RL and regulators:
        - If landfill materials are present within the waste site excavation limits, can the balance of the landfill be left for later remediation, after the waste site is remediated?
        - If remediation of the entire listed landfill is required, then inclusion by proximity documentation will be required.
        - An option is to work around these areas, leaving pipeline/waste site, and remediating with the landfills at a later date.
- FYI. 116-DR7 ink well tanks, will be inviestigated for presence of liquids, prior to remediation.

Attachment 8

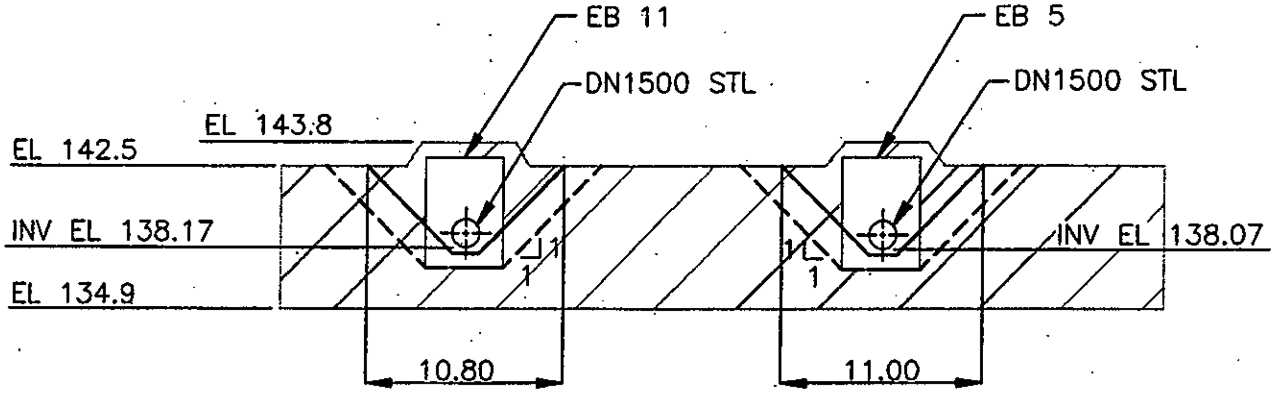


U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

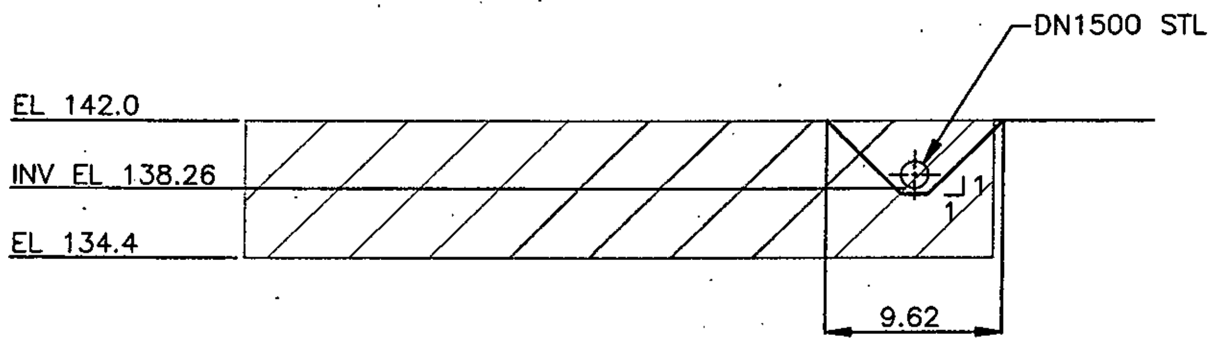
100 D AREA
SOLID WASTE BURIAL GROUNDS
EFFLUENT PIPELINE INTRUSION AREAS

1D:0419998

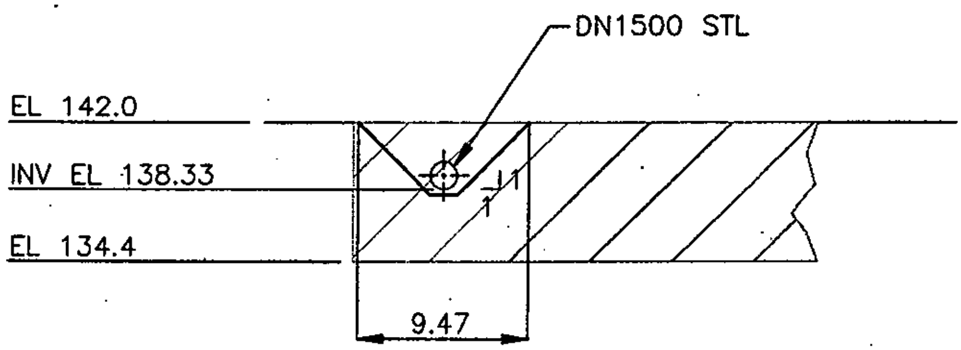
Attachment 8



SECTION "A" THROUGH 100-D-6 BURIAL GROUND



SECTION "B" THROUGH 100-D-32 BURIAL GROUND



SECTION "C" THROUGH 118-D-3 BURIAL GROUND

U.S DEPARTMENT OF ENERGY DOE FIELD OFFICE, RICHLAND HANFORD ENVIRONMENTAL RESTORATION PROGRAM	**100 D AREA** **SOLID WASTE BURIAL GROUNDS** **EFFLUENT PIPELINE INTRUSION AREAS**

CH_11ERC.DWG

CALCULATION COVER SHEET

Attachment 9

Project Title Revision of the RDR/RAWP for the 100 Area
Job No. 22192
Area 100 Area
Discipline Environmental ***Calc. No.** 0100X-CA-V0029
Subject Revision of PCB Cleanup Levels for Direct Soil Exposure
Computer Program EXCEL Spreadsheet **Program No.**

Committed Calculation ☒ **Preliminary** ☐ **Superseded** ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Total - 4 pages Cover/ Summary - 1pg Attm. 1 - 1 pg Attm. 2 - 1 pg	S. W. Clark S. W. Clark 2/16/99	J. D. Fancher J D Fancher 2/16/99	P. G. Doctor PG Doctor 2/17/99	F. M. Corpuz FM Corpuz 2/26/99	2/26/99

SUMMARY OF REVISION

Scanned:	Rev.	Date	Bar Code No.	Rev.	Date	Bar Code No.

*Obtain Calc. No. from DIS.

RDR/RAWP REVISION CALCULATION SUMMARY

Originator:	S. W. Clark	Date:	2/12/99	Calc. No.:	0100X-CA-V0029	Rev.:	0
Project:	RDR/RAWP Revision	Job No:	22192	Checked:	J. D. Fancher	Date:	2/16/99
Subject:	Revision of PCB Cleanup Levels for Direct Soil Exposure.						

PROBLEM STATEMENT:

The cleanup levels for nonradioactive contaminants in near-surface soil at Hanford are presented in Table 2-1 of the Remedial Design Report/Remedial Action Work Plan for the 100 Area, (RDR/RAWP), DOE/RL-96-17, Rev. 1, May 1998, U.S. Department of Energy, Richland, Washington. The value presented for polychlorinated biphenyls (PCBs) is no longer correct because the U.S. Environmental Protection Agency (EPA) has revised the cancer potency factor for ingestion of PCBs. Based upon the formula for calculation of MTCA Method B soil cleanup levels presented in WAC 173-340-740(3)(a)(iii)(B), the MTCA Cleanup Regulation, January 1996, the cleanup level for PCBs in Table 2-1 of the RDR/RAWP should be increased to 0.5 mg/kg from its current listing of 0.13 mg/kg.

GIVEN:

1) Revised cancer potency factor for ingestion of PCBs of 2.0 kg-day/mg based on EPA/600/P-96/001F and captured in the EPA Integrated Risk Information System (IRIS) available on the Internet at www.epa.gov/iris/, as defined in WAC 173-340-708(8).
2) Formula for calculation of MTCA Method B soil cleanup levels presented in WAC 173-340-740(3)(a)(iii)(B), January 1996.
3) Current PCB cleanup level of 0.13 mg/kg in Table 2-1 of the RDR/RAWP.

SOLUTION:

The calculation methodology is described in the MTCA Cleanup Regulation, January 1996, WAC 173-340-740(3)(a)(iii)(B). All input factors with the exception of the cancer potency factor are provided by WAC 173-340-740(3)(a)(iii)(B) and reproduced in Attachments 1 and 2. The data were entered into an EXCEL 97 spreadsheet (Attachment 2). Calculations were performed by creating formulae within the cells.

RESULTS:

The revised cleanup value for PCBs to be presented in Table 2-1 of the RDR/RAWP is calculated to be 0.5 mg/kg.

ATTACHMENTS:

1. Calculation of MTCA Method B Soil Cleanup Levels for PCBs
2. EXCEL 97 spreadsheet: Cleanup level calculation

ATTACHMENT 1

Calculation of MTCA Method B Soil Cleanup Levels for Polychlorinated Biphenyls (PCBs)

The MTCA Method B soil cleanup levels for hazardous substances that present an incremental cancer risk are calculated using the following formula from the MTCA Cleanup Regulation, January 1996, WAC 173-340-740(3)(a)(iii)(B):

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{RISK x ABW x LIFE x UCF1}}{\text{CPF x SIR x AB1 x DUR x FOC}}$$

Where RISK = Acceptable cancer risk level (1 in 1,000,000 = 1E-06)
ABW = Average body weight over the period of exposure (16 kg)
LIFE = Lifetime (75 years)
UCF1 = Unit conversion factor (1,000,000 mg/kg)
CPF = The Cancer Potency (slope) Factor as defined in WAC 173-340-708(8) with units of kg×day/mg (1/mg/kg/d). [The revised cancer potency factor for ingestion of 2.0 kg-day/mg is based on EPA/600/P-96/001F and captured in the EPA Integrated Risk Information System (IRIS) available on the Internet at www.epa.gov/iris/. The value of 2.0 kg-day/mg is the upper-bound CSF for ingestion for high risk and high persistence PCB congeners (Aroclor-1254 and Aroclor-1260).]
SIR = Soil ingestion rate (200 mg/day)
AB1 = Gastrointestional absorption rate (1.0)
DUR = Duration of exposure (6 years)
FOC = Frequency of contact (1.0)

Substituting these values in the equation above from MTCA, the Soil Cleanup Level (mg/kg) for Aroclor-1254 and Aroclor-1260 is:

$$SCL(mg/kg) = \frac{1E-06 \times 16(kg) \times 75(yr) \times 1E+06(mg/kg)}{2.00(kg \times day/mg) \times 200(mg/day) \times 1.0 \times 6(yr) \times 1.0} = 0.5(mg/kg)$$

Attachment 1 Sheet No. 1 of 1
Originator S. W. Clark Date 2/12/99
Chk'd By J. D. Fancher Date 2/16/99
Calc. No. 0100X-CA-V0029 Rev. No. 0

ATTACHMENT 2

Calculation of MTCA Method B soil cleanup levels for PCBs using the formula from		
WAC 173-340-740(3)(a)(iii)(B):		
Soil cleanup level (mg/kg)= (RISK*ABW*LIFE*UCF1)/(CPF*SIR*AB1*DUR*FOC)		
Variable	Value	Description
RISK	1E-06	MTCA acceptable cancer risk level (1 in 1,000,000)
ABW	16	kg average body weight
LIFE	75	years lifetime
UCF1	1000000	mg/kg unit conversion factor
CPF	2	kg-day/mg cancer potency slope factor
SIR	200	mg/day soil ingestion rate
AB1	1	gastrointestinal absoption rate
DUR	6	years duration of exposure
FOC	1	frequency of contact
Soil cleanup level (mg/kg) =		0.5

Hanford Barrier Performance Monitoring and Testing

Past Workscope		Workscope Considerations for FY 99	
Tasks	**Subtasks**	**Minimal Subtasks[a]**	**Estimated Cost**
Biointrusion	**Plant Intrusion** • Root Tubes **Animal Intrusion** • Animal Use/Borrowing Survey	Annual Animal Use/Burrowing Survey[1]	2 K
Vegetation	**Plant Dynamics and Physiology** • % Cover/Survivorship • Shrub Height/Size • Leaf Area Index • Gas Exchange • Root Distribution/Density • Reproduction • Species List	Annual Plant Survey[3]	5 K
Stability	**Settlement Gauges** **Surface Topography** **RipRap Side Slope Creep Gauges**	Annual Stability Survey[2]	5 K
Water Balance	**Silt Loam Water Content** • Vertical NeutronTubes (Θ) • Heat Dissipation Units (Ψ) • Time Domain Reflectometry Probe (Θ) • Precipitation	TDR Installation, Maintenance, Automated Data Logging, Data Reduction and Interpretation[5]	35 K
	Drainage • Above Asphalt - Tipping Buckets (D) - Dosing Siphons (D) - Pressure Transducers (D) - Horizontal Neutron Tubes (Θ) • Under Asphalt - Lysimeters (D) - Horizontal Neutron Tubes (Θ)	Drainage Measurement System Calibration, Maintenance, Automated Data Logging, Data Reduction and Interpretation[4]	50 K
Erosion	**Wind** • Surface Inflation/Deflation • Pea Gravel Content **Water** • Surface Runoff		
Reporting	**Annual Reports**	Annual Letter Reporting	20 K

[a] Priorities; 1 being the highest

E9903025

Attachment 10

RCRA GROUNDWATER MONITORING AT THE 216-S-10 POND AND DITCH

B. A. WILLIAMS
PACIFIC NORTHWEST NATIONAL LABORATORY

UNIT MANAGERS MEETING
APRIL 15, 1999

Attachment 11

OVERVIEW

- Located southwest outside the 200 West Area perimeter fence. The ditch is open, unlined, 6' deep , 4' wide at bottom, 2250 ft. long and the pond (S-10) is unlined, 5 acres in size.

- Active life: Ditch started receiving wastewater in August 1951. 1954-The S-10 Pond was dug and began service. 1984 – Pond and southwest end of Ditch decommissioned, backfilled. 1984-91 - Ditch received non-dangerous and non-regulated wastewater. October 1991 - All wastewater discharges stopped.

- Wastewater volume –From 1986 to 1991 received 50,000,000 gal/Yr. (~136, 986 gal/day)

- From 1951 to1972 received wastewater from REDOX (202-S) isotope separation, constituents poorly documented. (Unspecified quantity of aluminum nitrate discharged in 1954).
  From 1972-1980????
  From 1980 to 1984 – disposal site for chemical engineering lab. Lab produced simulated double-shell tank slurry.
  Release event in 1983 – 110 gals or 1, 560 lbs. of slurry discharged to ditch and pond, including $NaNO_3$, NaOH, Na_3PO_4, NaF, NaCl, and $K_2Cr_2O_7$.
  From 1984 to 1991 the ditch received only non-hazardous, non-regulated waste water from the 202-S building (physical controls and operating procedures).

REGULATORY REQUIREMENTS

- 216-S-10 Pond and Ditch is a *Resource Conservation and Recovery Act of 1976* (RCRA) dangerous waste facility in interim status. Scheduled to be closed sometime after the year 2000

- RCRA groundwater monitoring at the S-10 Pond and Ditch is regulated under Washington Administrative Code (WAC) 173-303-400 [EPA Federal regulations 40 CFR 265, Subpart F through R].

Attachment 11

MONITORING HISTORY

- RCRA detection groundwater –monitoring network established in 1990-1991; monitoring began in 1991. The groundwater-monitoring plan (WHC-SD-EN-AP-018) outlines the program to determine the crib's impact on the quality of groundwater in the uppermost aquifer.

- Initial network consisted of six wells (two upgradient and 4 downgradient)

  - 299-W26-7, and 299-W26-8 are upgradient (background) wells

  - 299-W26-9, 299-W26-10, 299-W26-11, and 299-W26-12 are the downgradient (point of compliance) wells

  - Except for 299-W26-11, all wells were completed as uppermost aquifer (Ringold Unit E Gravel) monitoring wells with 20 ft. screens [WAC 173-160]. 299-W26-11 was completed to monitor perching conditions encountered above the Plio-Pleistocene silt; it went dry when the effluent disposal ceased in 1991.

  - Well 299-E27-2 was installed in 1992 to monitor the bottom of the unconfined aquifer. This well is not used for the upgradient –downgradient statistical comparisons because it is screened in a different interval deeper in the aquifer.

First Year – 1992-1993

- Background levels for the contaminant indicator parameters were established in accordance with 490 CFR 265.92.

- Constituents included RCRA indicator parameters, drinking water standard parameters, groundwater quality parameters, and site specific constituents. (All wells were sampled at least once for the Appendix IX constituents).

Following Years – 1993 present

- Replicate averages, collected semi-annually after the first year, were compared against the critical mean for each indicator parameter.

Attachment 11

MONITORING HISTORY (continued)

- Groundwater monitoring results reported semiannually in quarterly reports and summarized annually in the Hanford Site Groundwater Monitoring Fiscal Reports (e.g. PNNL-12086).
- TOX is gradually increasing in upgradient well 299-W26-8 and downgradient well 299-W26-10 as a result of the encroaching upgradient carbon tetrachloride plume. Carbon tetrachloride concentrations are near the drinking water standard of 5ug/L.
- Uranium has always been elevated in upgradient well 299-W26-8. (see plot).
- Chromium increasing steadily since 1996 in upgradient well 299-W26-7 (see plot).
- June 1998, upgradient well 299-W26-8 is too dry to sample and is dropped from the network. Critical means are recalculated for one upgradient well, 299-W26-7.

CURRENT STATUS

- Monitoring under interim-status groundwater detection monitoring will continue until facility is closed under RCRA final status regulations as scheduled under the TPA.
- Monitoring network consists of minimum required 4 wells; 1 upgradient and 3 downgradient.
  - 299-W26-7 is upgradient well
  - 299-W26-9, 299-W26-10, and 299-W26-12 are downgradient wells
  - Last sample at W26-10 was collected in March 1999. This well is being replaced in CY 99 under M-24-00.

ISSUES

- Increasing chromium levels near S-10 Pond will be evaluated to determine source; continued chromium increase could trigger groundwater assessment investigation. Currently no corrective action planned at the S-10 Pond and Ditch.

- Two downgradient wells, 299-W26-9 and 299-W26-10, are going dry; only one well is being replaced this year.

- No candidate downgradient wells near the line of compliance. The only downgradient candidate is an existing non-RCRA compliant well, 699-32-77 which has a cement plug in it.

REFERENCES

40 CFR 264, Code of Federal Regulations, Title 40, Part 264, *Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.*

40 CFR 265, Code of Federal Regulations, Title 40, Part 265, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.*

Maxfield, H. L. 1979. *Hanford – 200 Area Waste Sites.* RHO-CD-673, Rockwell Hanford Operations, Richland, Washington

U. S. Department of Energy (DOE). 1996a. *Hanford Facility Dangerous Waste Permit Application General Information Portion.* DOE/RL-91-28, Rev. 2, Richland Operations Office, Richland, Washington.

WAC 173-160, State of Washington Department of Ecology, Washington Administrative Code Chapter 173-160, *Minimum Standards for Construction and Maintenance of Wells,* Olympia, Washington.

WAC 173-303-400, State of Washington Department of Ecology, Dangerous Waste Regulations, Washington Administrative Code Chapter 173-303-400, *Interim Status Facility Standards,* Olympia, Washington.

WHC-SD-EN-AP-018. Airhart, s. P., J. V. Borghese, and S. Dudziak. 1990. *Interim-Status Ground-Water Monitoring Plan for the 216-S-10 Pond and Ditch,* WHC-SD-EN-AP-018, Rev. 0, Prepared by Pacific Northwest Laboratory for Westinghouse Hanford Company, Richland, Washington.

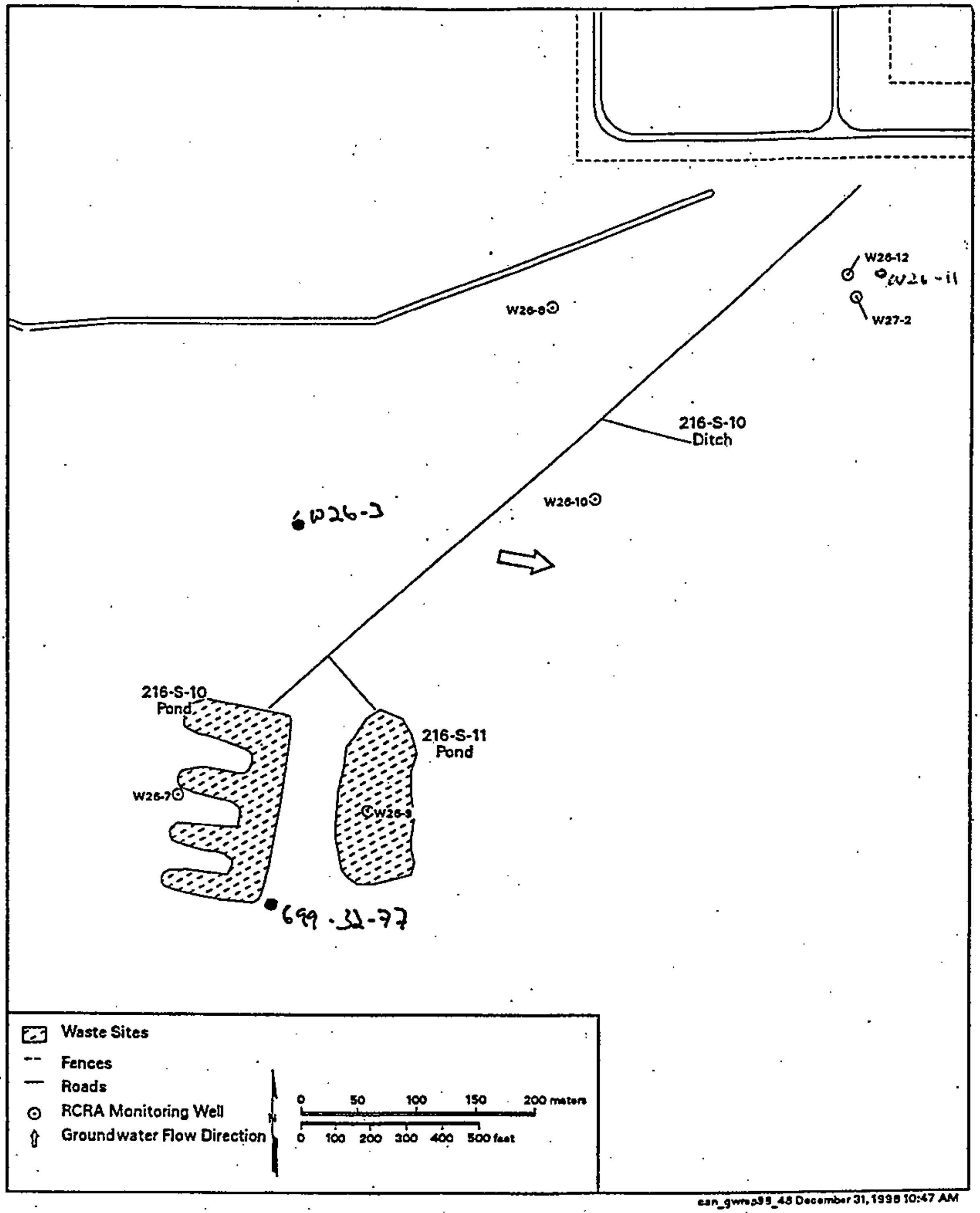


Figure A.5. Monitoring Well Locations for 216-S-10 Pond and Ditch

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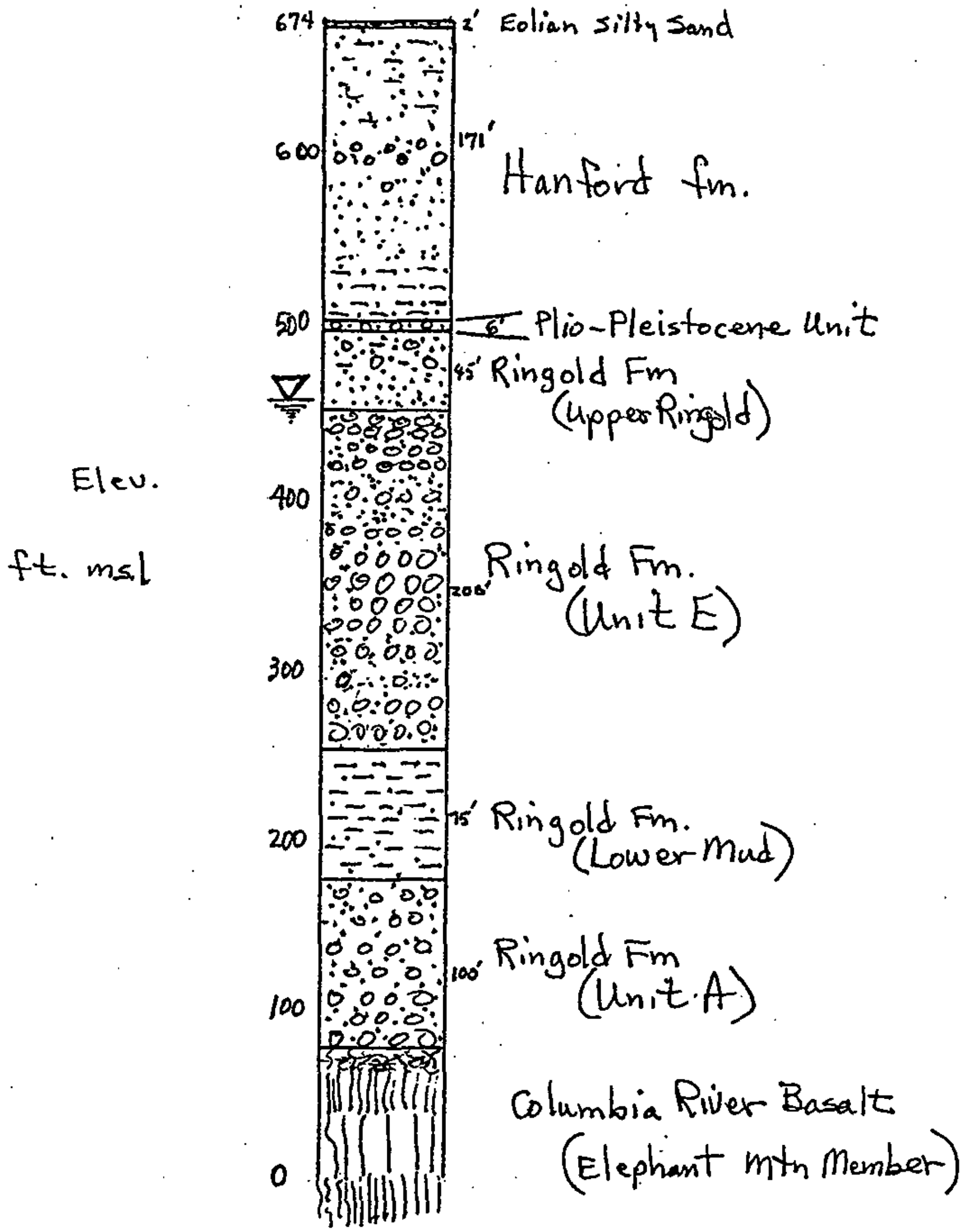
STRATIGRAPHY 216-S-10 Ditch & Pond



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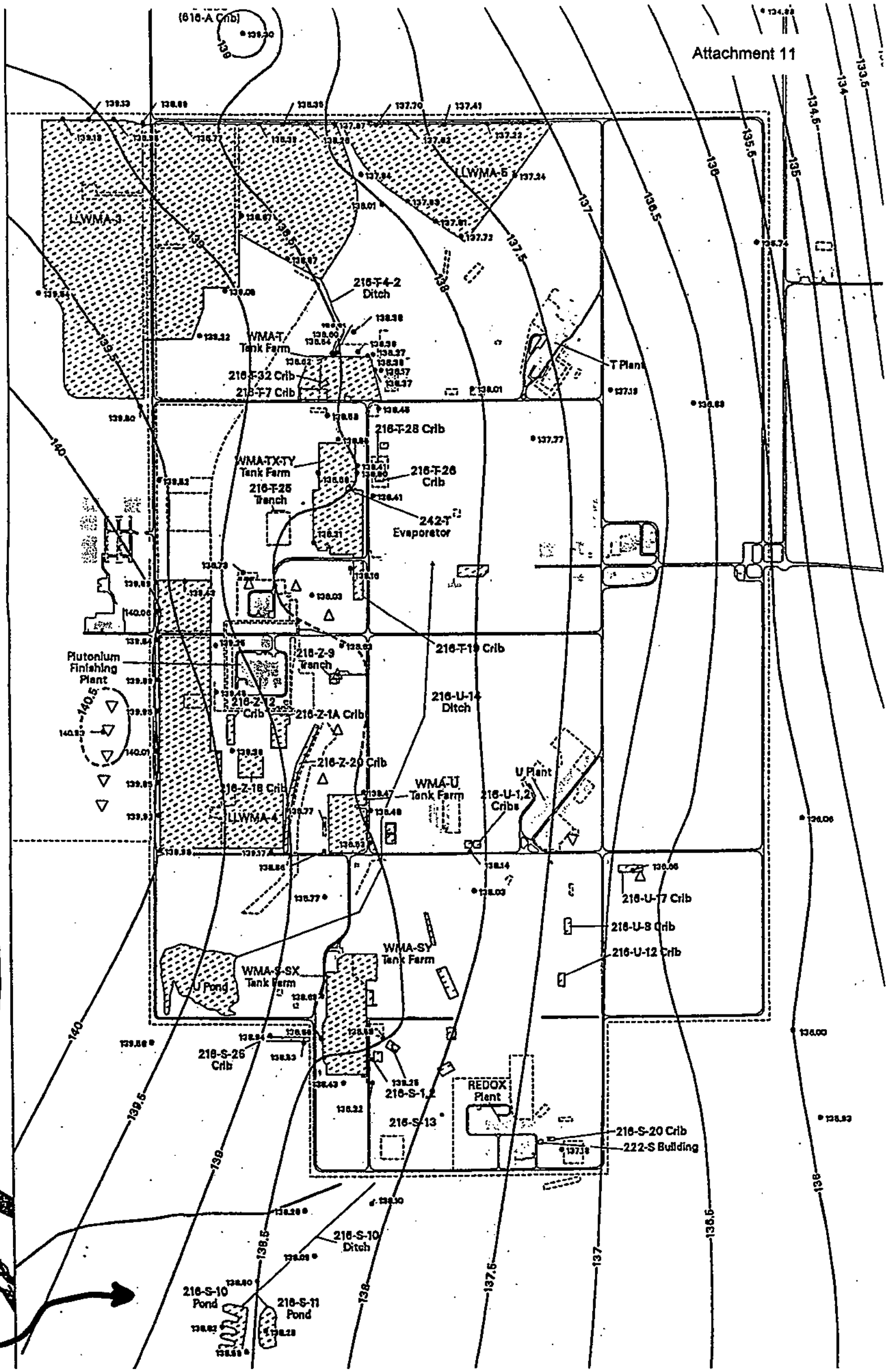

S-10
POND +
DITCH

Table A.5. Monitoring Wells and Constituents for 216-S-10 Pond and Ditch (adapted from WHC-SD-EN-AP-018)

Well	Hydrogeologic Unit Monitored	Sampling Frequencies	Water-Level Measurements	Well Standard	Other Network
299-W26-7[91]	Top of unconfined	Quarterly[(a)]	Quarterly	RCRA	Surveillance
299-W26-8[90]	Top of unconfined	Dry[(b)]	--	RCRA	Surveillance
299-W26-9[90]	Top of unconfined	Semiannual	Semiannual	RCRA	--
299-W26-10[91]	Top of unconfined	Semiannual	Semiannual	RCRA	Surveillance
299-W26-12[91]	Top of unconfined	Semiannual	Semiannual	RCRA	--
299-W27-2[92]	Base of unconfined	Semiannual	Semiannual	RCRA	Surveillance

Contamination Indicator Parameters		Groundwater Quality Parameters	
pH		Chloride	Phenols
Specific conductance		Iron (filtered)	Sodium (filtered)
Total organic carbon		Manganese (filtered)	Sulfate (filtered)
Total organic halides			

Drinking Water Parameters		Site-Specific Parameter
Barium (filtered)	Gross beta	Alkalinity
Cadmium (filtered)	Nitrate	
Chromium (filtered)	Silver (filtered)	
Fluoride	Turbidity	
Gross alpha		

(a) Upgradient wells sampled in December 1997 and March, June, and September 1998 for total organic halides.
(b) Well dry; last sampled March 1998.
Shading = Upgradient well.
Superscript = Year of installation.
RCRA = Well constructed to RCRA standards.

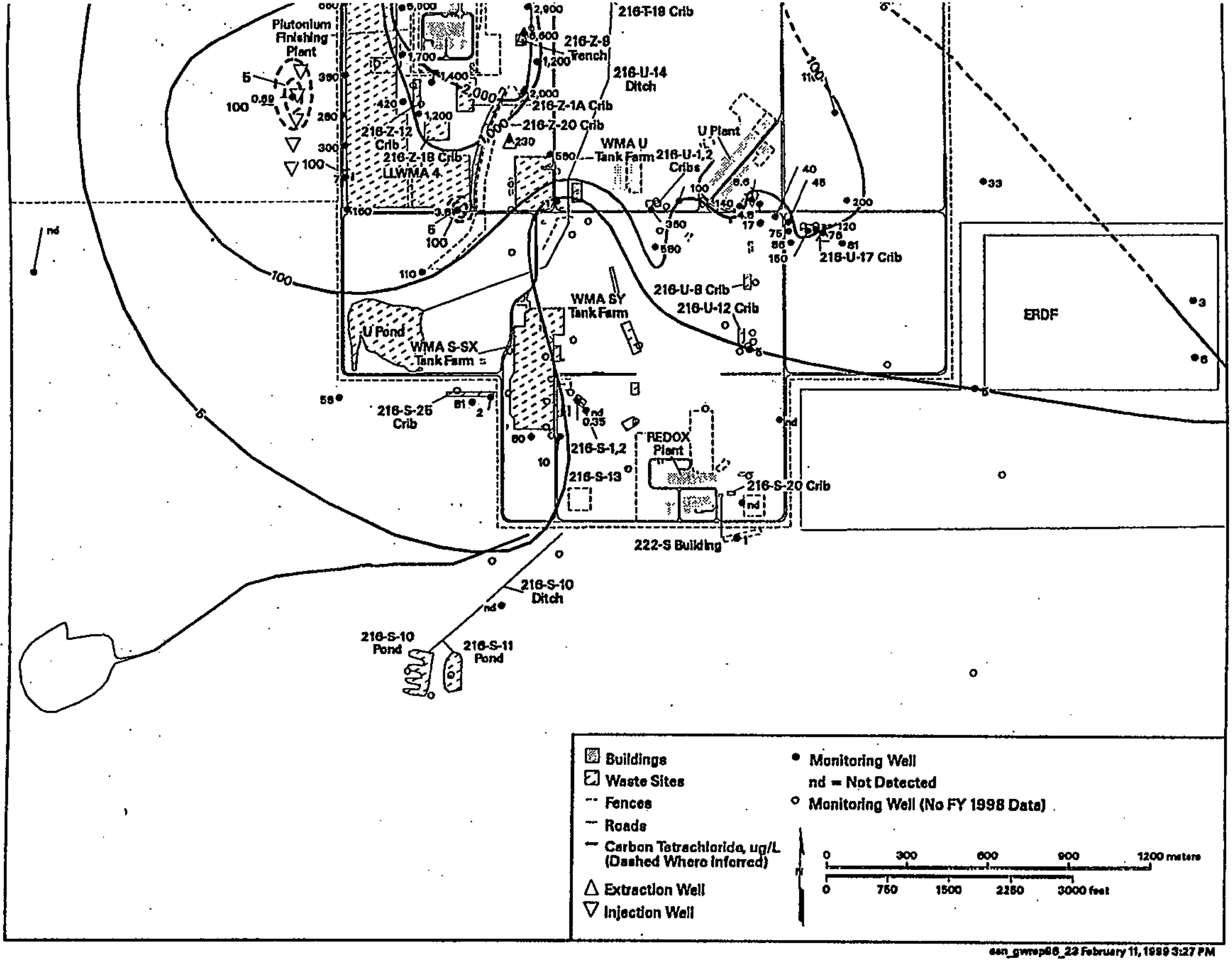

Figure 5.9-7. Average Carbon Tetrachloride Concentrations in 200-West Area, Top of Unconfined Aquifer

Attachment 11

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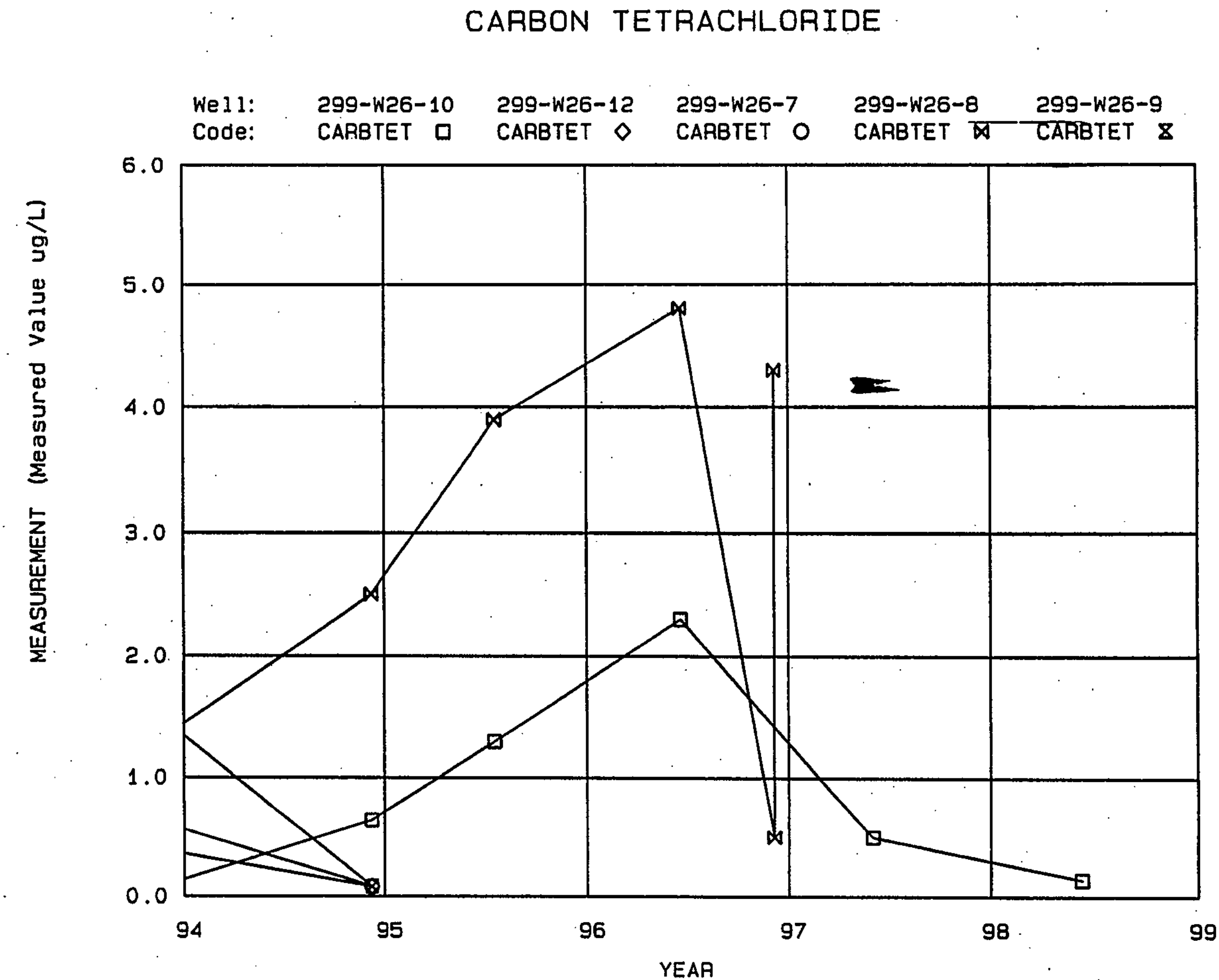

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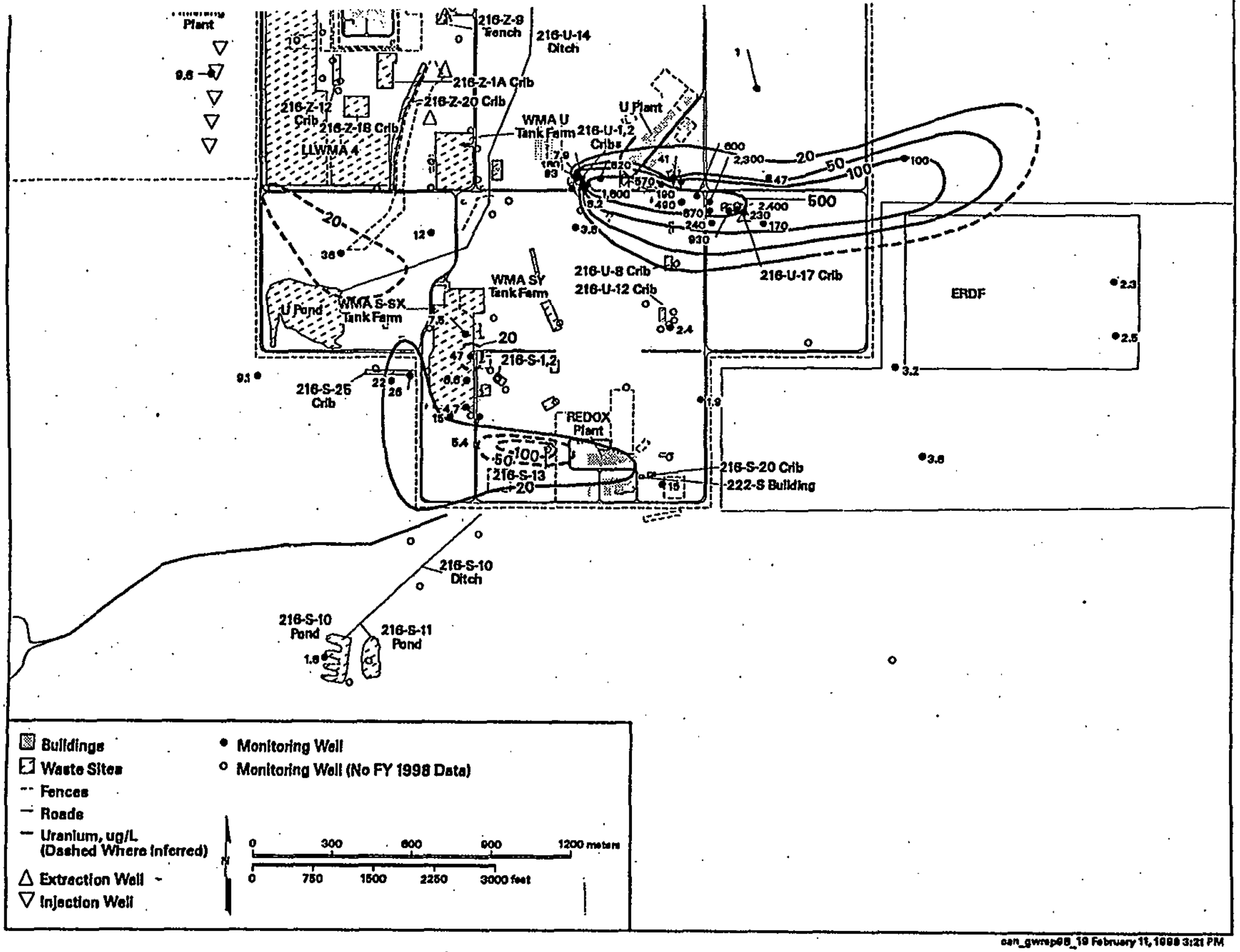

Figure 5.9-5. Average Uranium Concentrations in 200-West Area, Top of Unconfined Aquifer

Attachment 11

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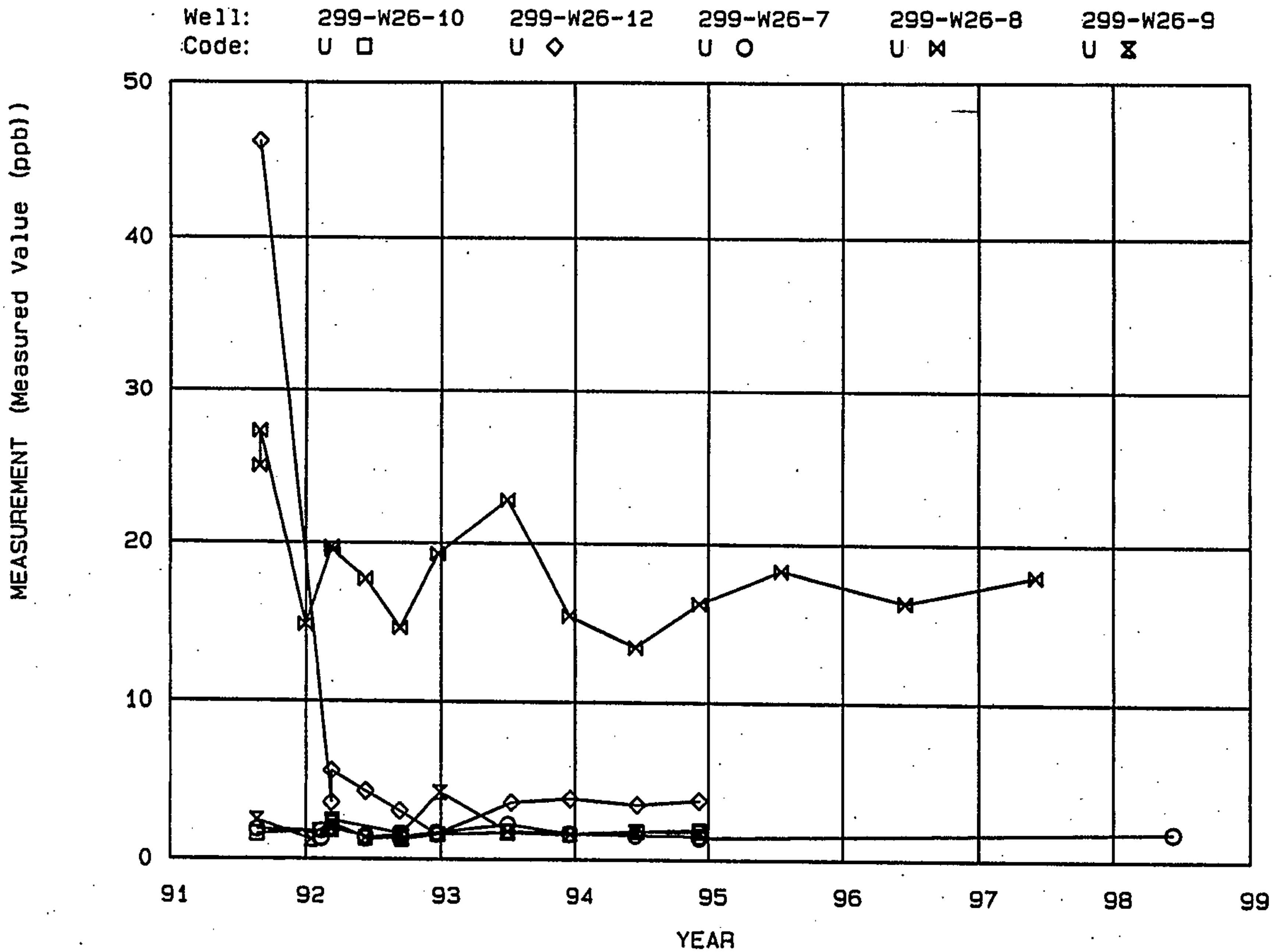
URANIUM



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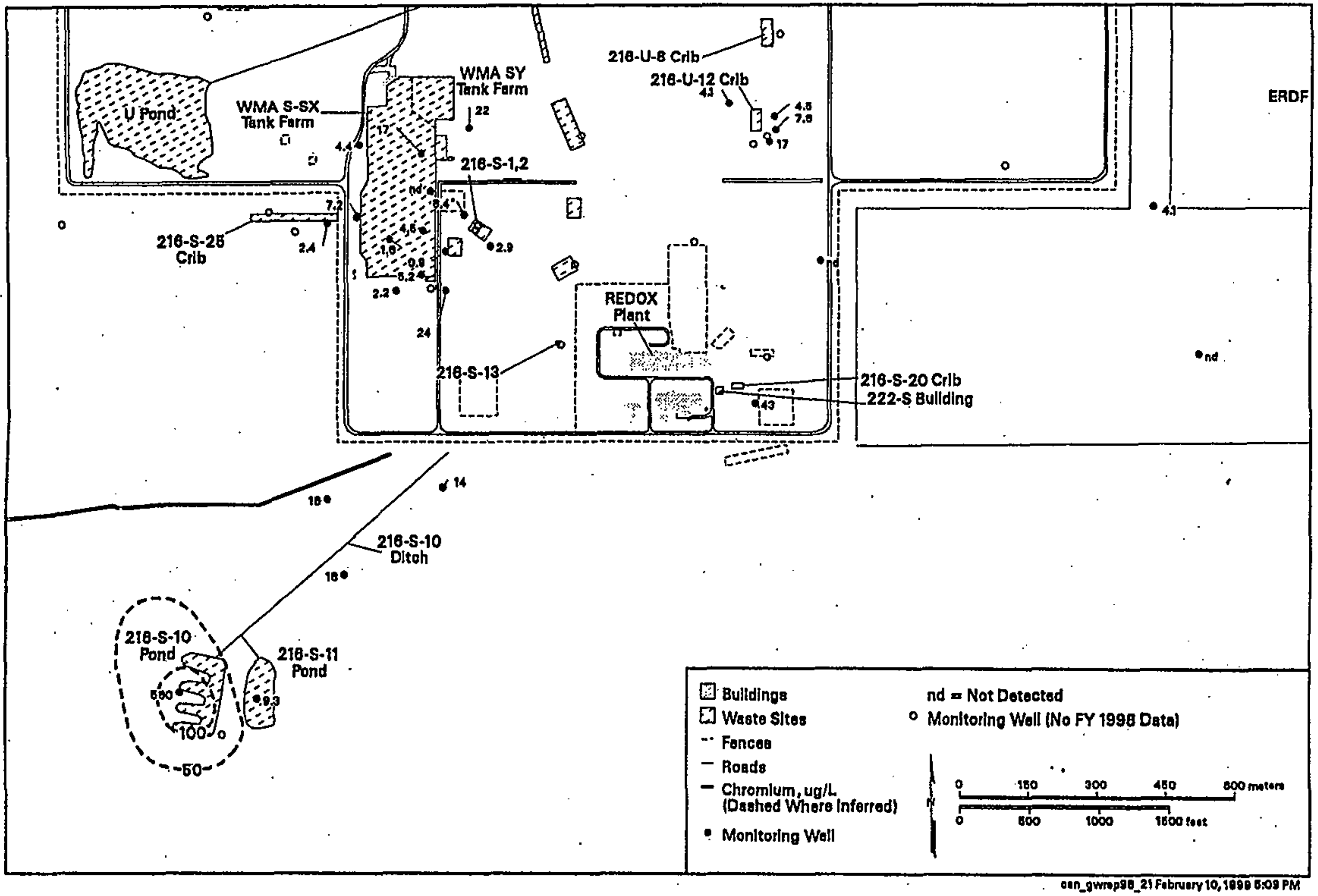
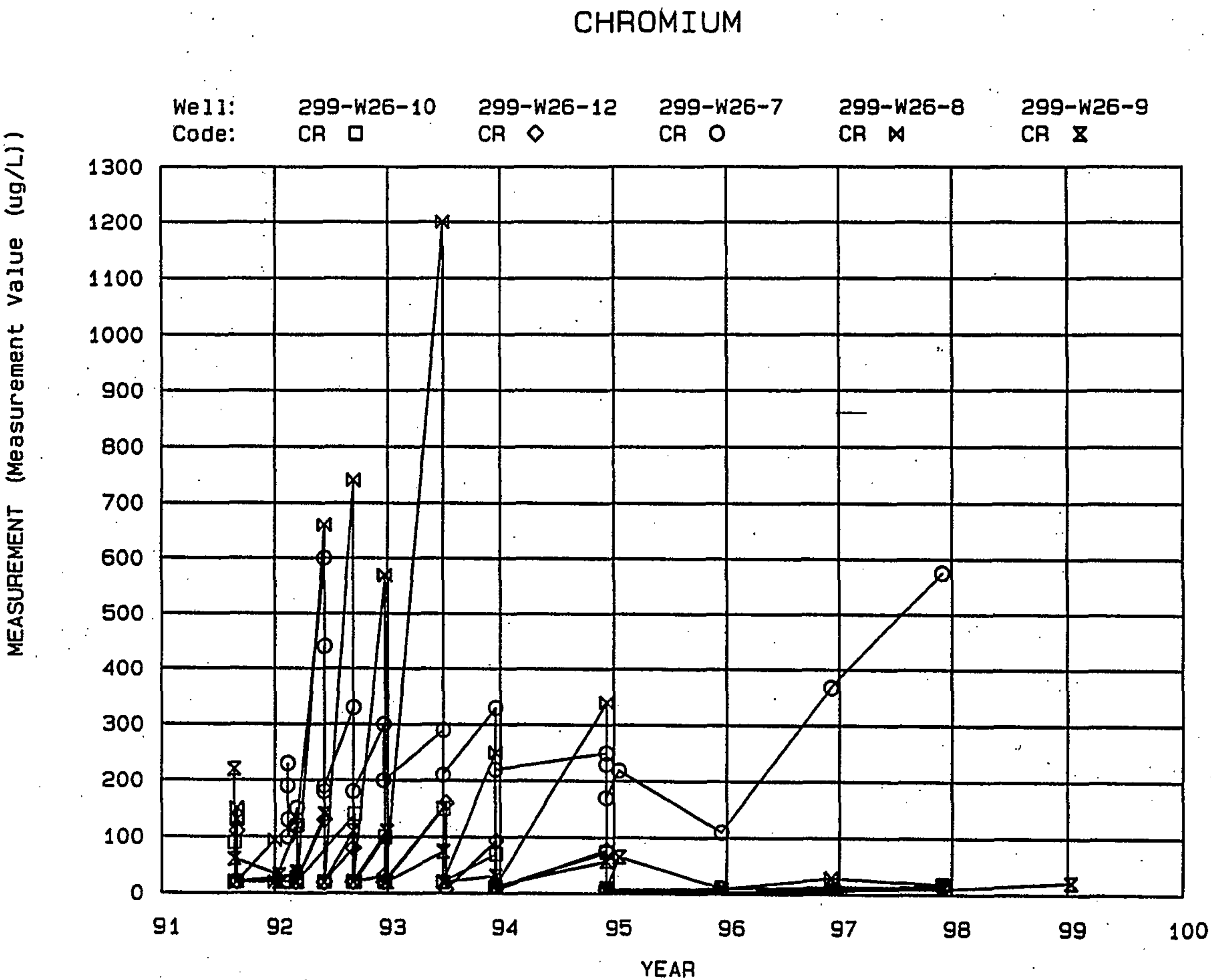


Figure 5.9-14. Average Chromium Concentrations in Wells Monitoring 216-S-10 Pond and Ditch, Top of Unconfined Aquifer



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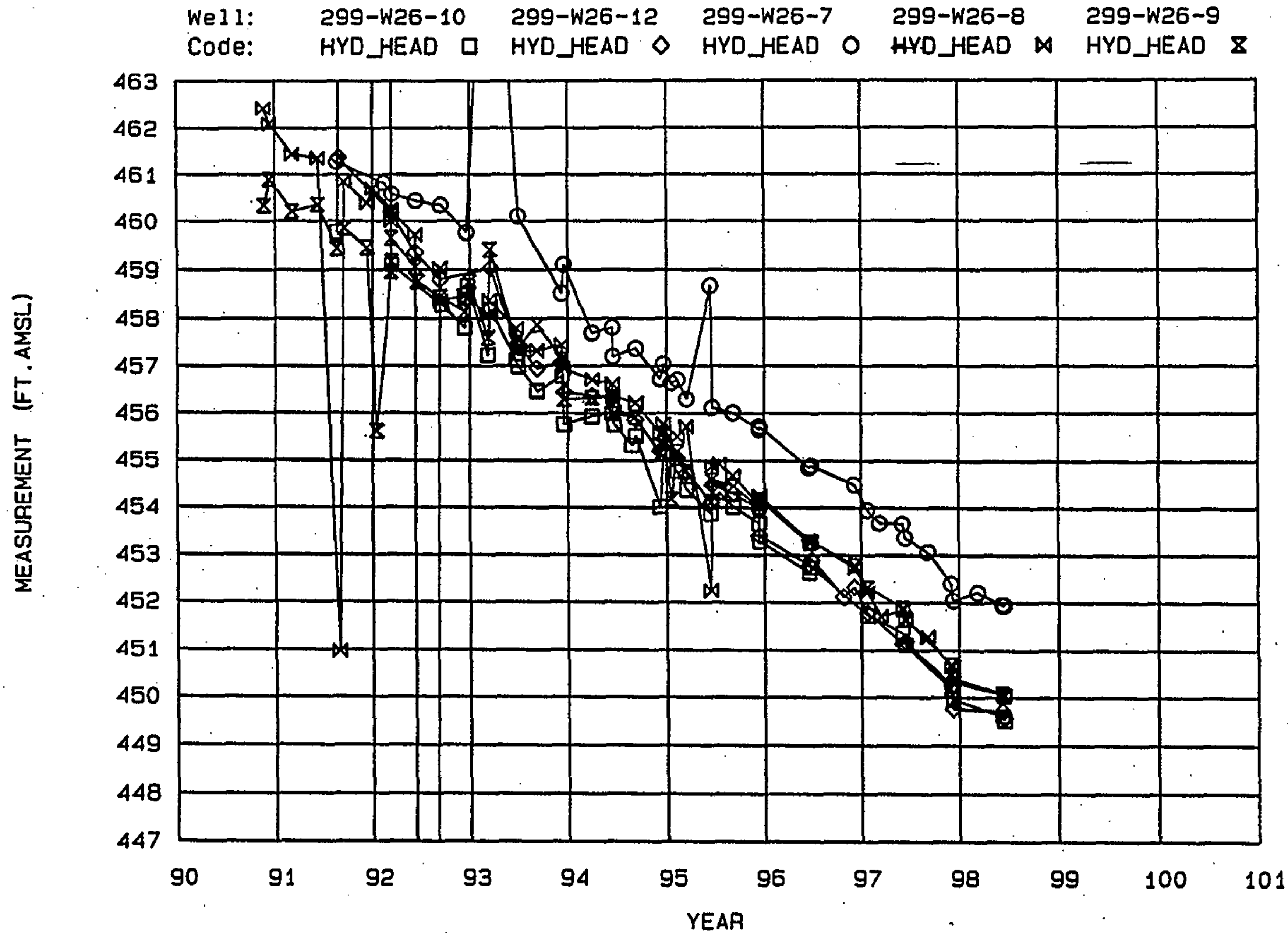
Attachment 11

216-S-10 POND AND DITCH
Water Level Decline and Expected Years of Well Use

Well Number	Depth to Bottom of Screen (ft)	Water Level (ft) June 1998	Feet of water in Screen	Feet of Water Minus 2.0*	Decline Ft/Yr	Years Remaining **
299-W26-7 (UG)	443.39	451.95	8.6	6.6	1.4	4.7
299-W26-8 (UG)	447.63	Dry	Dry	Dry	Dry	Dry
299-W26-9	446.31	450.03	3.7	1.7	1.6	1.1
299-W26-10	445.89	449.53	3.6	1.6	1.6	1
299-W26-12	444.35	449.71	5.4	3.4	1.5	2.3
299-W27-2	This Well	Is a Deep	Completion	Plenty of	Water	

- * Hydrostar pumps have a small screen attached to the bottom of the pump. Pump cannot be lowered much more than 2.0 ft. from the bottom of the well screen without modifying the pump intake mechanism or utilizing a different sampling technique.
- ** Years until water level is 2.0 ft. above bottom of well screen. When the water table declines to this level, the well must be pumped very slowly to prevent drawdown. If excessive drawdown is unavoidable, then another pumping method must be used or the well must be replaced.

WATER LEVELS



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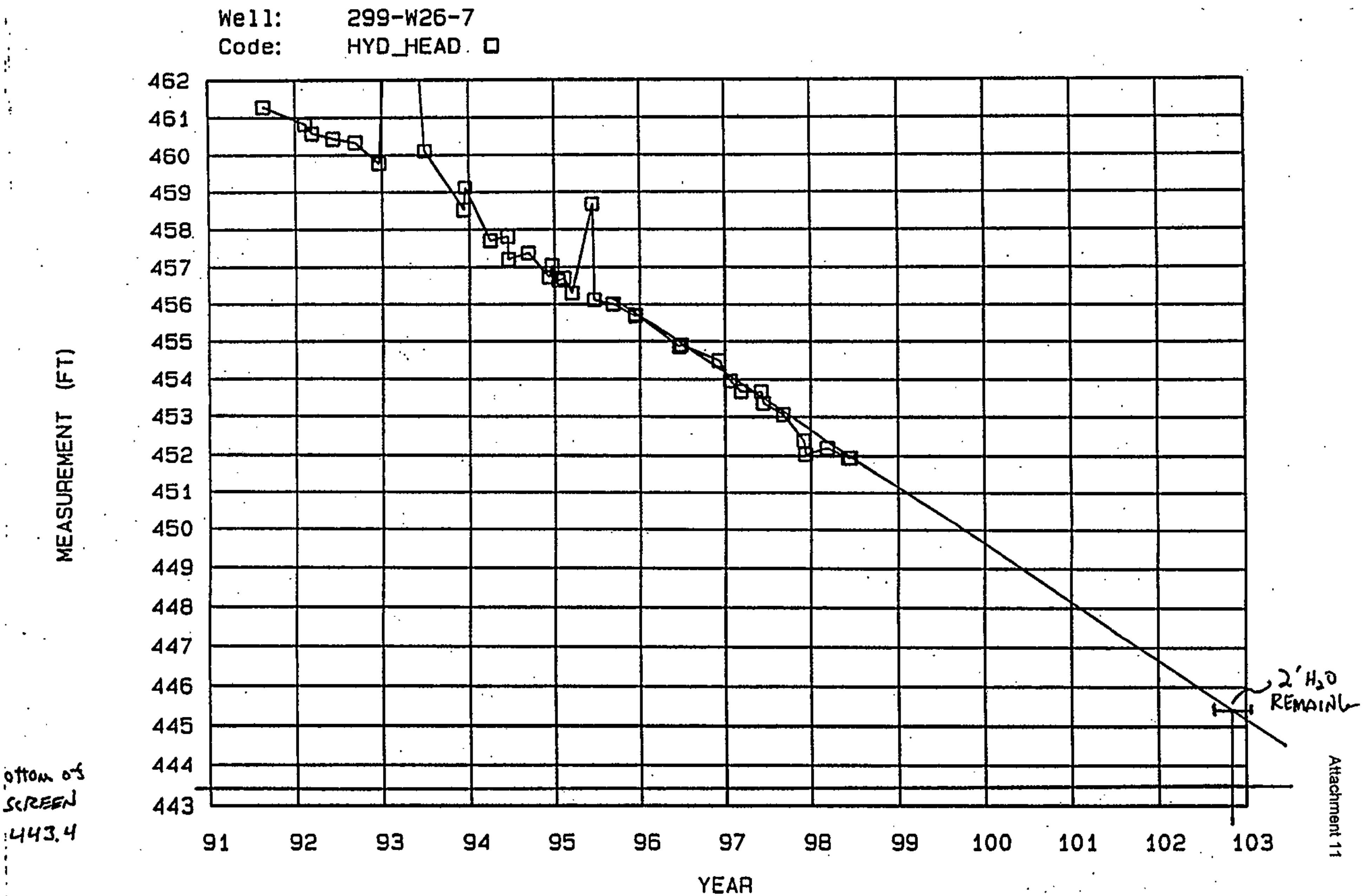
299-W26-7



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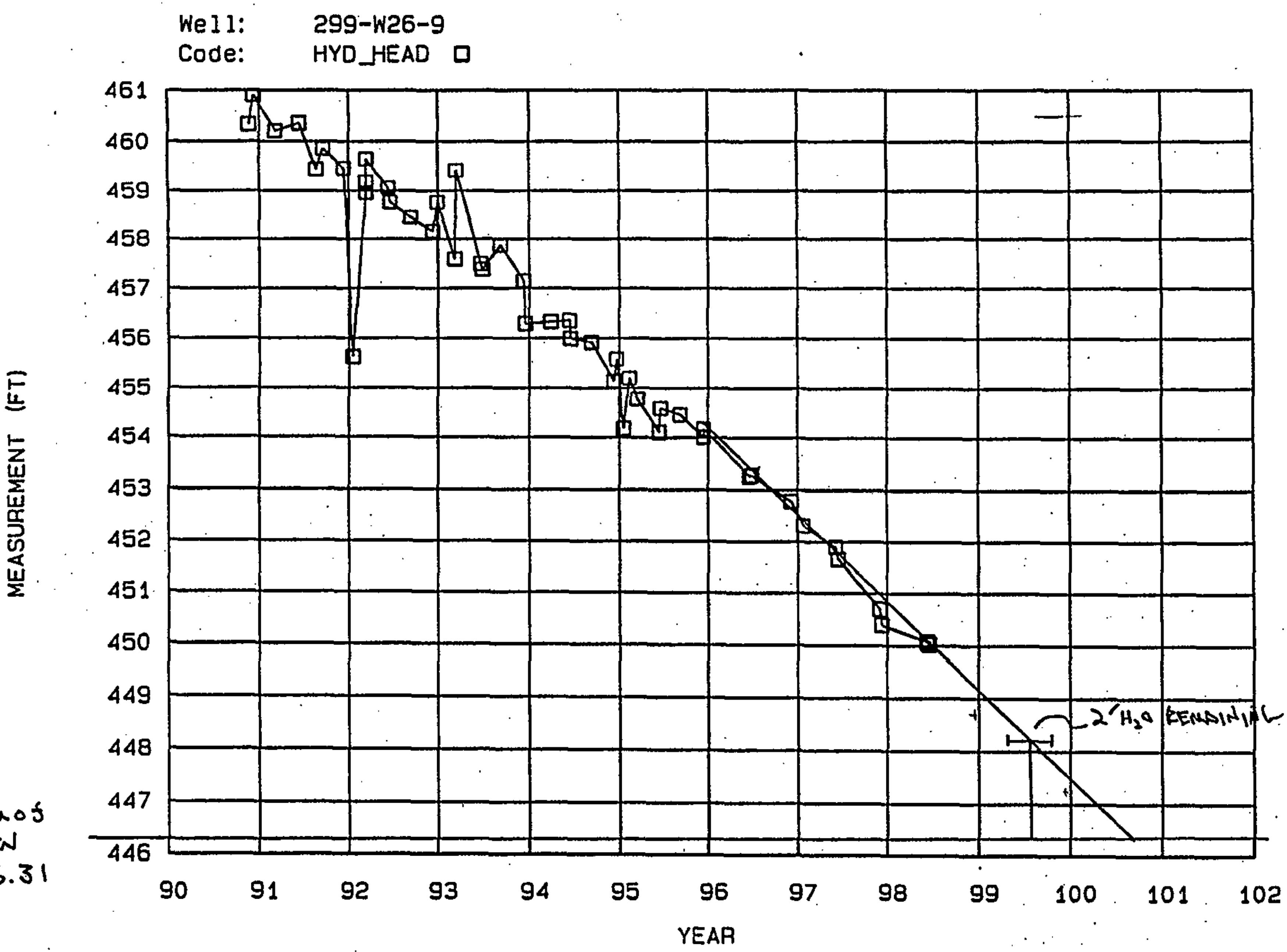
299-W26-9



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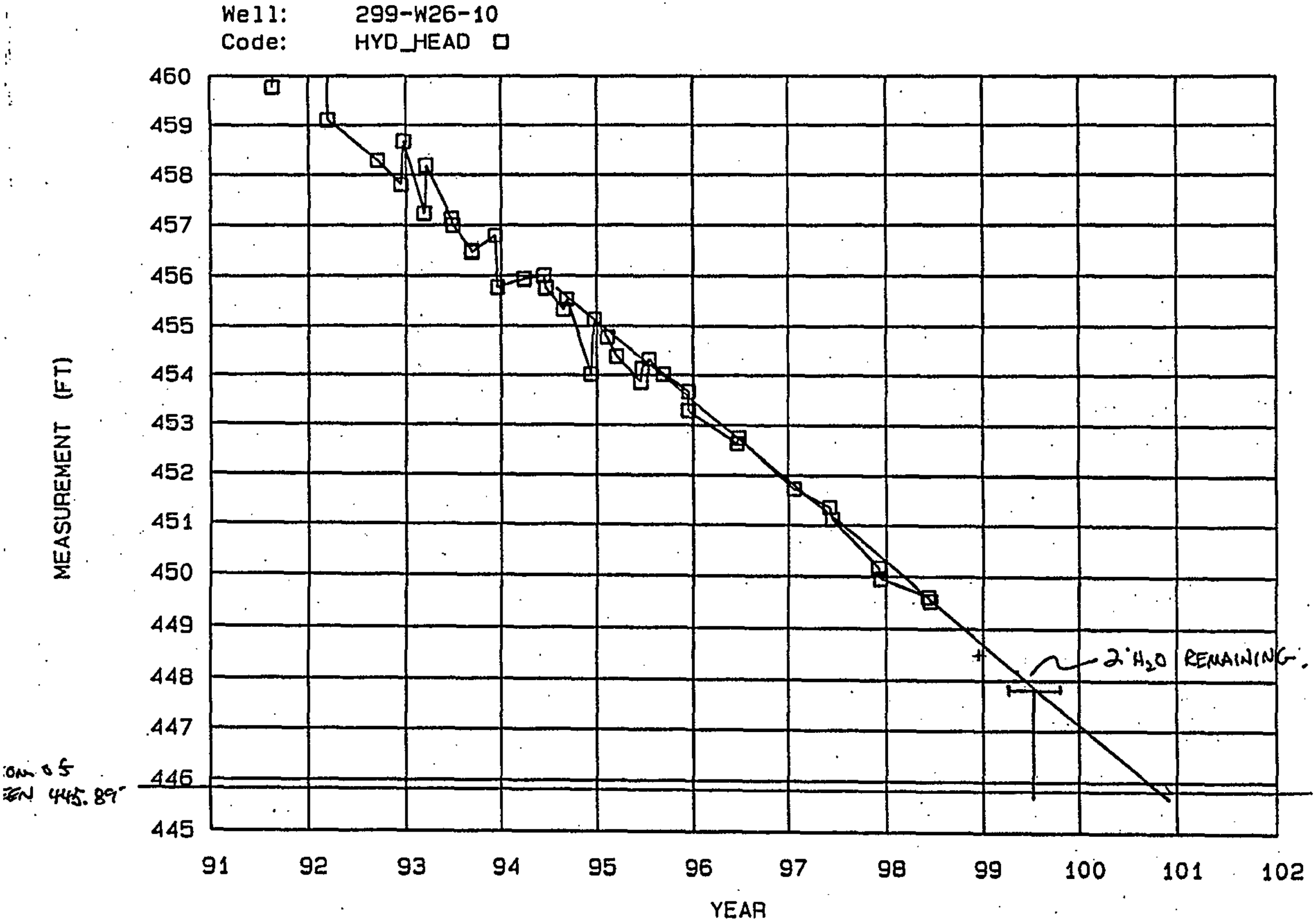

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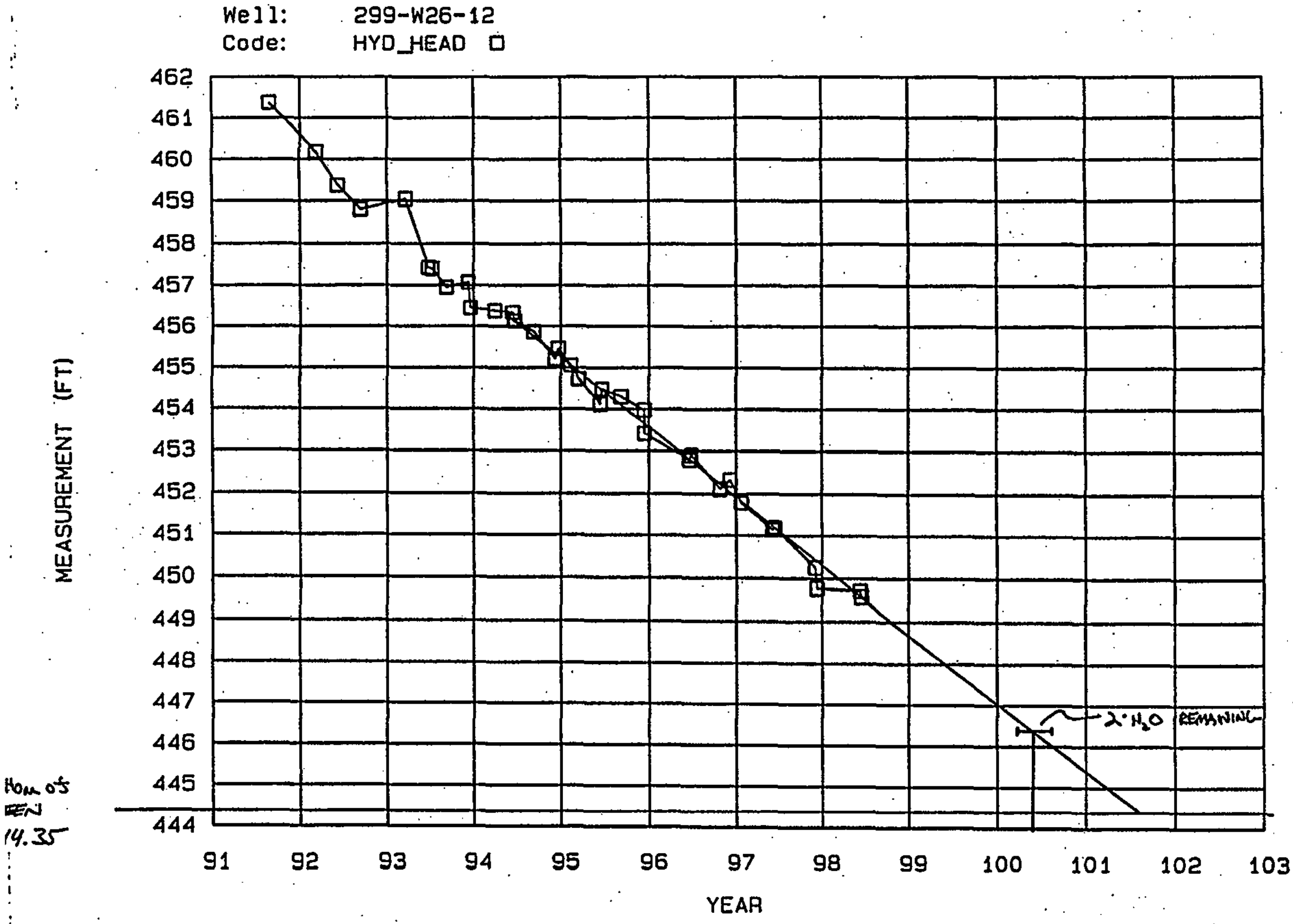
299-W26-12



Attachment 11

Background Information on the 200-UP-1 IRM

200-UP-1 P&T System

The 200-UP-1 P&T system was constructed to remove the primary contaminants of Tc-99 and uranium, and the secondary contaminants of CCl_4 and nitrate, from a contaminant plume in the 200-UP-1 Groundwater Operable Unit (Figure 1). The remedial action designated by the ROD has the following specific objectives (RAOs):

- Reduce contamination in the areas of highest concentration of uranium and Tc-99 to below 10 times (480 µg/L) the cleanup level under the *Model Toxics Control Act* (MTCA) for uranium, and 10 times (9,000 pCi/L) the maximum contaminant level (MCL) for Tc-99.
- Reduce potential adverse human health risks through reduction of contaminant mass.
- Prevent further movement of these contaminants from the highest concentration area.
- Provide information that will lead to development and implementation of a final remedy that will be protective of human health and the environment.

Background

Process wastewater consisting primarily of dilute nitric acid containing uranium. technetium-99 and other fission products was disposed to the ground through cribs associated with the U-Plant in the Hanford 200 West Area between 1951 and 1968. Mobile contaminants reached the groundwater during the years when the cribs were in use. Most of the uranium, however, was retained in the upper portion of the soil column beneath the cribs in a uranium phosphate mineral phase until the final two years of crib operation when highly acidic waste solutions were discharged to the crib. The acid waste dissolved the uranium mineral deposits in the soil column and increased its solubility and mobility.

The mobile uranium was transported to groundwater again in the mid-1980s when large columns of process water were discharged to a new crib located in the vicinity of these cribs. The process water created a perched zone of saturation that spread laterally to the soil column containing the soluble uranium. Uranium was then carried to groundwater via unsealed casings or through the soil column. When this contamination was identified in groundwater samples in 1985 a uranium recovery program was instituted to reduce contaminant concentrations. The source of nitrate contamination is the co-disposed dilute nitric acid.

Prior to the IRM. the uranium and technetium-99 plumes covered an area of about 0.24 mi^2 (Figures 2 and 3). The area targeted by the IRM is about 7% of the total plume area, but contains 57% and 21% of the total inventory of dissolved uranium and technetium-99, respectively (BHI-00187). Maximum concentrations measured in the high concentration areas were:

Nitrate	1,700,000 µg/L
Uranium	3,900 µg/L
Technetium	34,300 pCi/L

The vertical extent of contamination is estimated at 15-18 m (50-60 ft) below the water table (about 76 m bgs [250 ft]). Technetium-99 is mobile, while uranium is less mobile because of sorption to the soils.

From March 1994 to September 1995 a pilot-scale treatability test was conducted at a pumping rate of 57-L/min (15 gal/min) to address both the uranium and technetium-99 plumes. The treatability test demonstrated that ex situ ion exchange was effective at removing uranium and Tc-99 from extracted groundwater to below MCLs/guidelines (proof-of-principle demonstration).

Based on the results of the treatability test results, Phase I pump-and-treat operations commenced September 25, 1995, using a single extraction and a single injection well, pumping at a rate of 190 L/min (50 gal/min). This system operated until February 7, 1997. During this period of time, operations continued anticipating release of the *Interim Remedial Measure Proposed Plan for the 200-UP-1 Operable Unit, Hanford, Washington* (DOE-RL 1995b), and issuance of a ROD. System operations were shut down from February 8 to March 30, 1997, while the extraction well surface discharge piping was reconfigured for transport of groundwater to the Effluent Treatment Facility (ETF) in the 200 East Area.

On February 25, 1997 a ROD was issued (DOE et al. 1997) for the 200-UP-1 pump-and-treat operations. The selected remedy consisted of pumping the highest concentration zone of the uranium and Tc-99 groundwater plumes and routing the groundwater to the ETF in the 200 East Area for treatment. Before issuance of the ROD, groundwater was treated onsite using ex situ ion-exchange technology and granular activated carbon (for the CCl_4). Nitrate was not treated at that time. After the ion-exchange treatment, the water was returned to the aquifer through an upgradient injection well. Since March 31, 1997, contaminated groundwater has been pumped from the extraction well and transported via pipeline 11.3 km (7 mi) to the ETF in the 200 East Area for treatment. Treated groundwater is discharged to the State-Approved Land Disposal Site (SALDS) north of the 200 West Area. All four contaminants, nitrate, CCl_4, uranium and Tc-99, are removed at the ETF.

More detailed site characterization and background information on the operable unit and the pump-and-treat activity is provided in the following documents:

1. *Remedial Investigation/Feasibility Study Work Plan for the 200-UP-1 Groundwater Operable Unit* (DOE-RL 1994)

2. *Engineering Evaluation/Conceptual Plan for the 200-UP-1 Groundwater Operable Unit Interim Remedial Measure* (BHI-00187, Rev. 2). For a listing of site background and characterization documents, refer to the work plan (DOE-RL 1997).

Current Conditions

The plume configurations at the end of fiscal year 1998 (September) are shown in Figures 4 and 5. The current plumes are overlaid on the baseline remedial target area. Significant progress has been made in remediating the technetium-99 to the IRM goal of 9,000 pCi/L (10x the MCL). Only two areas remain where technetium-99 concentrations are above the remediation goal. Figure 6 contains a trend plot of technetium-99 at the pumping well and demonstrates that there is a rapid decrease in concentrations, which confirms the plume map changes.

Little or no progress has been made in reducing uranium concentrations to the remediation goal of 480 µg/L, even after 3 years of pumping and treatment of over 360.5 million liters of groundwater. Figure 7 shows that uranium concentrations have remained relatively constant in the pumping well, confirming the plume maps. This trend is consistent with the trend plots for the monitoring wells (attached). Table 1 lists the production of water and the mass of contaminants removed since inception of operations. Contaminant trend plots are also attached for the site monitoring wells.

It should be noted that there is a regional decline in water levels (0.4 m/yr) in this area due to the residual mound from the former U-Pond surface disposal site. This decline is affecting the monitoring well network. Several wells have already gone dry (Figure 1), including two within the last couple of months. Even so, it appears that longer-term monitoring is still viable even with the loss of these wells.

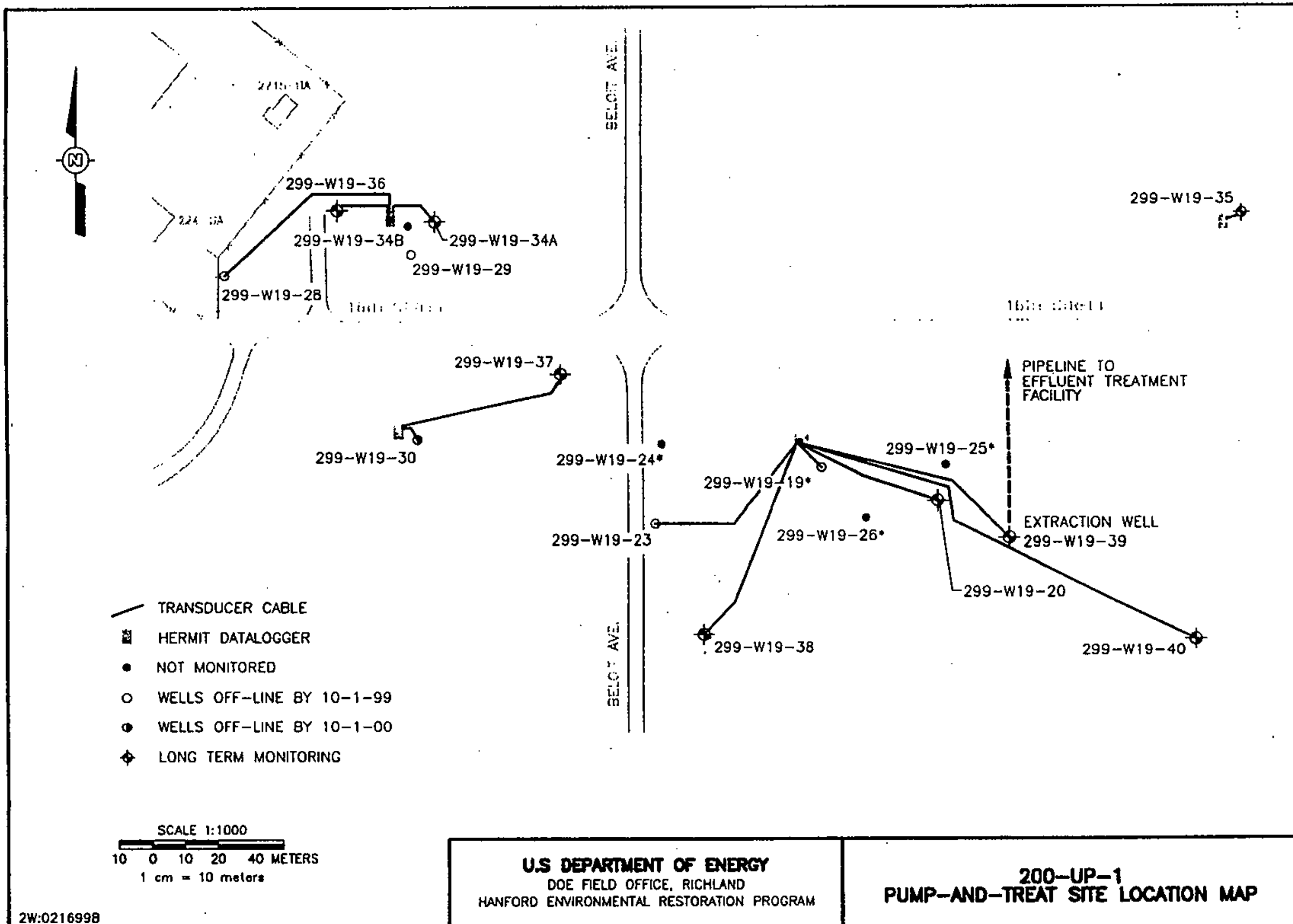
Site specific modeling (Figure 8) shows capture of the plume under the current well configuration. The pump-and-treat operation is successfully capturing and containing both plumes. A larger regional model released by Chiaramonte et al. (1996), looked at contaminant movement and risks over the next 200 years under several different scenarios including:

1. Technetium-99 and uranium without remediation activities, without retardation, and after 200 years (Figures 9 and 10)
2. Uranium with remediation activities, without retardation, and after 200 years (Figure 11)
3. Uranium without remediation activities, with retardation, and after 200 years (Figure 12)

This modeling work is significant because it shows that:

1. Even without remediation the residual plumes do not move off the Central Plateau in 200 years. Concentrations fall below the MCLs.
2. With remediation and no retardation, the uranium plume still reaches the 200 East Area in 200 years. Concentrations again decline to less than the MCL.
3. With no remediation and with a small retardation factor, the uranium plume doesn't leave the 200 West Area after 200 years. Only a very small core area remains above the MCL. This model run is consistent with the much slower rate of remediation observed for uranium. Where Tc-99 concentrations are declining "rapidly", uranium has show no real change.

Figure 1.



2W:0216998

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

200-UP-1
PUMP-AND-TREAT SITE LOCATION MAP

Attachment 12

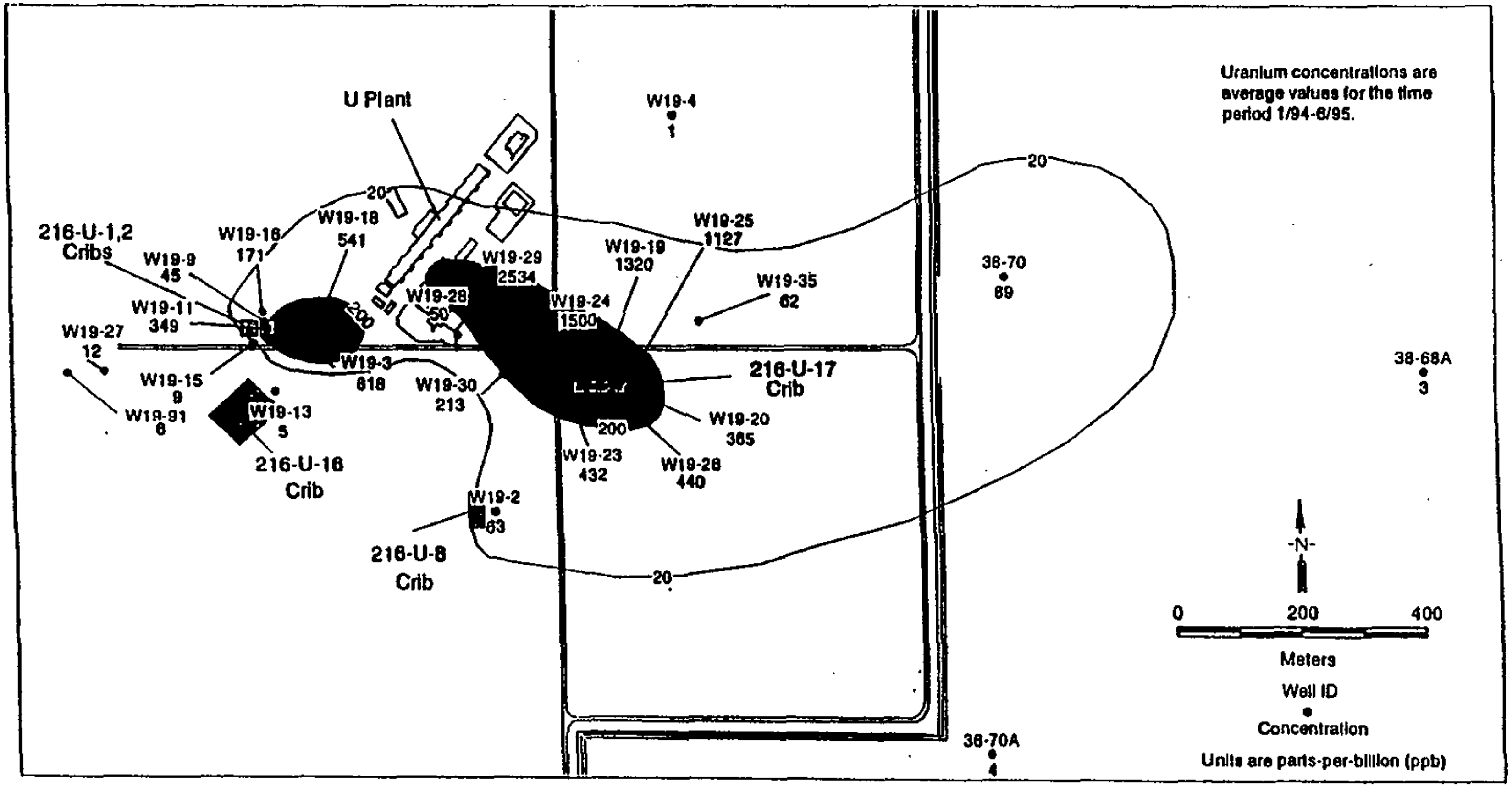


Figure 2. Concentration Isopleths for Uranium (in ppb).

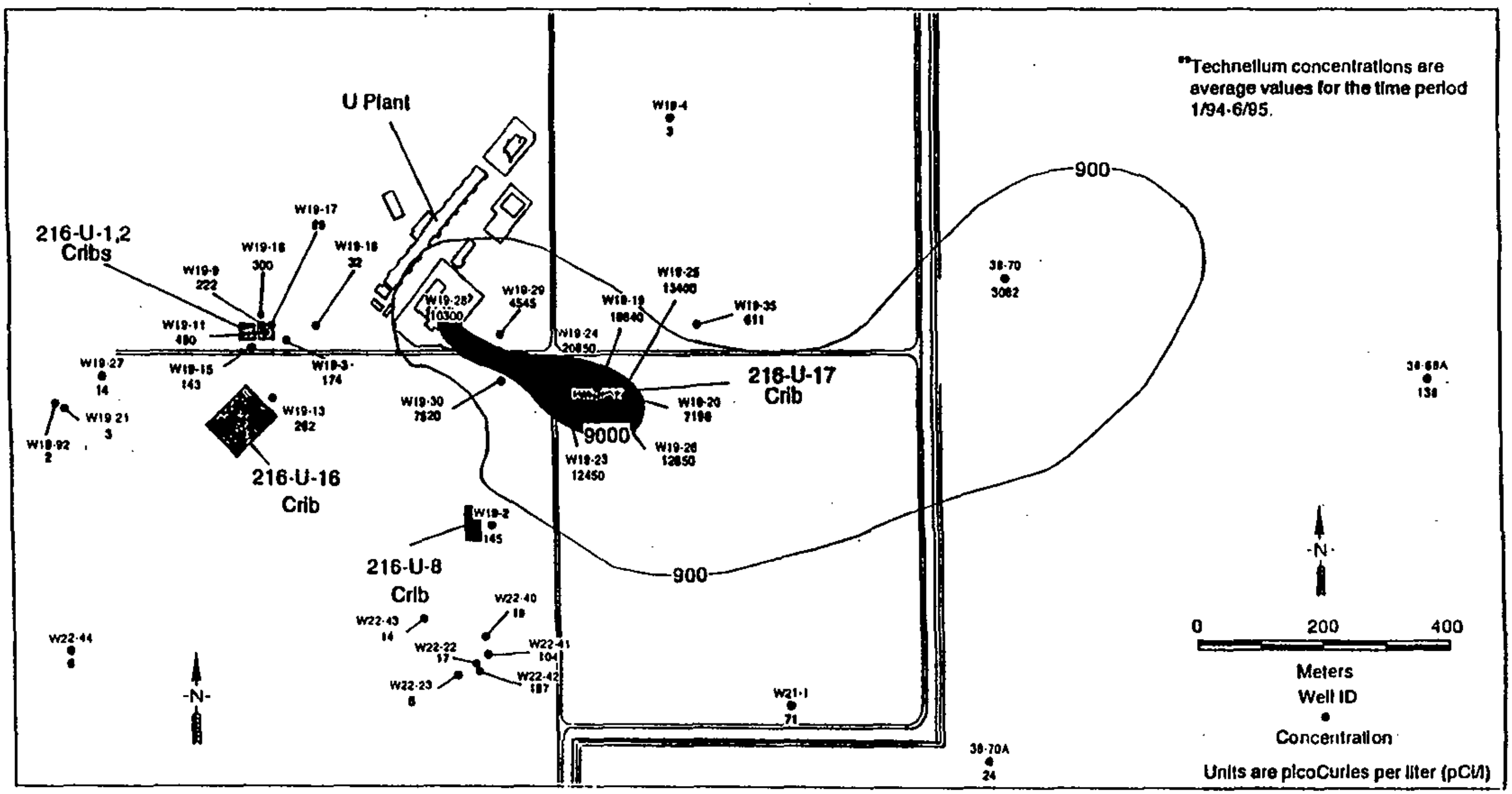


Figure 3. Concentration Isopleths for Technetium-99 (in pCi/L).

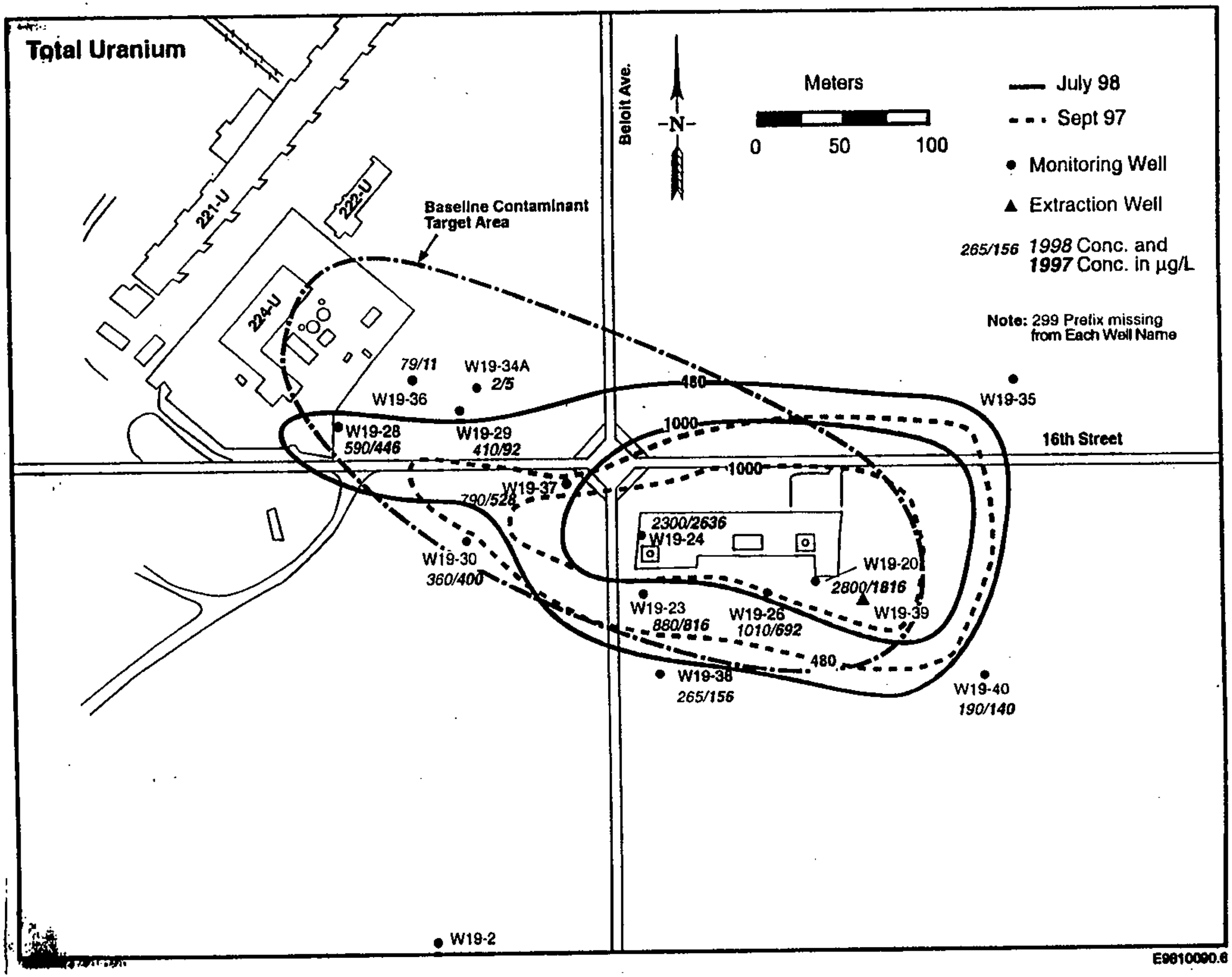


Figure 4. Uranium Plume for September 1997 and September 1998.

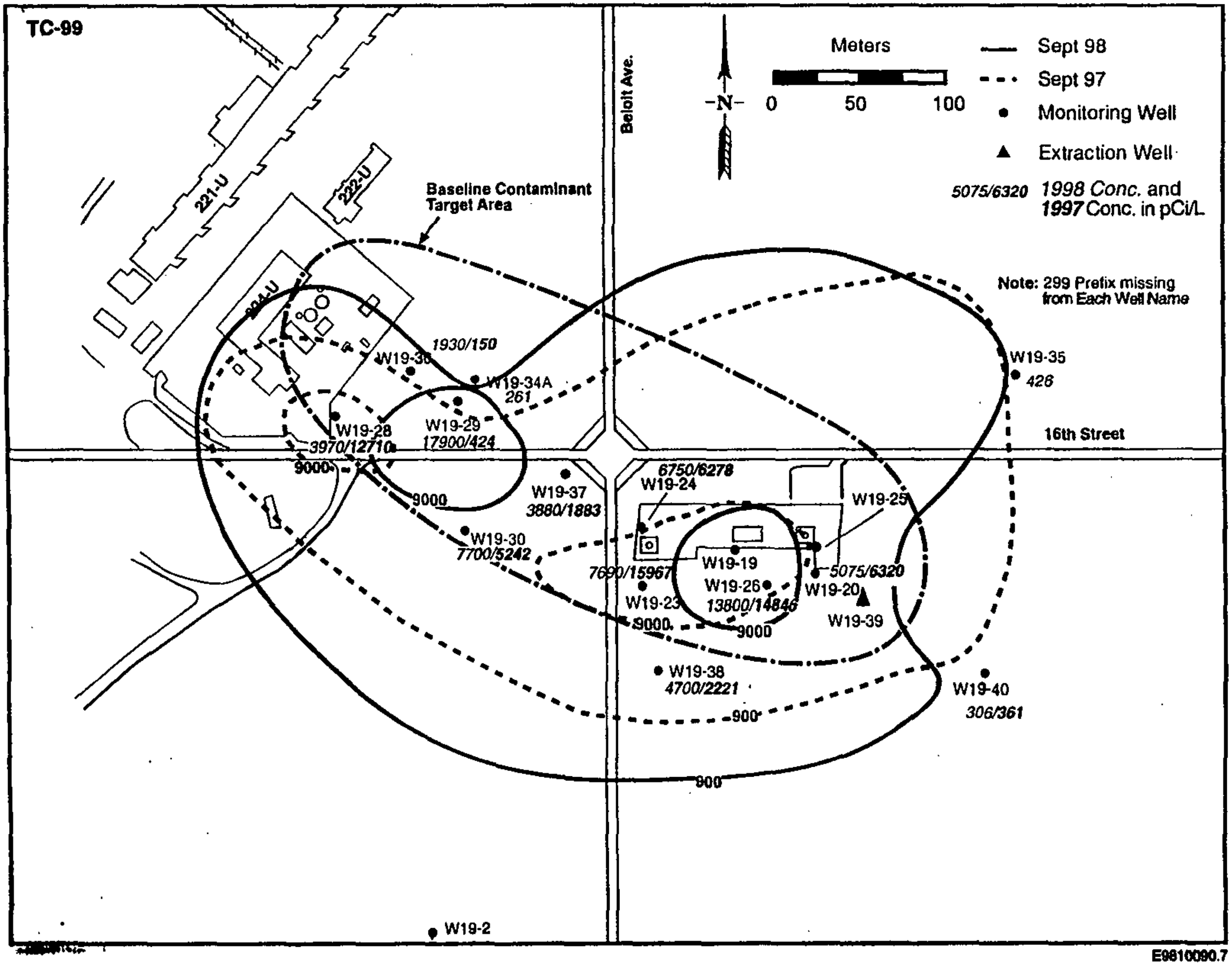


Figure 5. Technetium-99 Plume for September 1997 and September 1998.

Figure 6. Technetium-99 Concentrations at Extraction Well 299-W19-39 Through December 31, 1998.

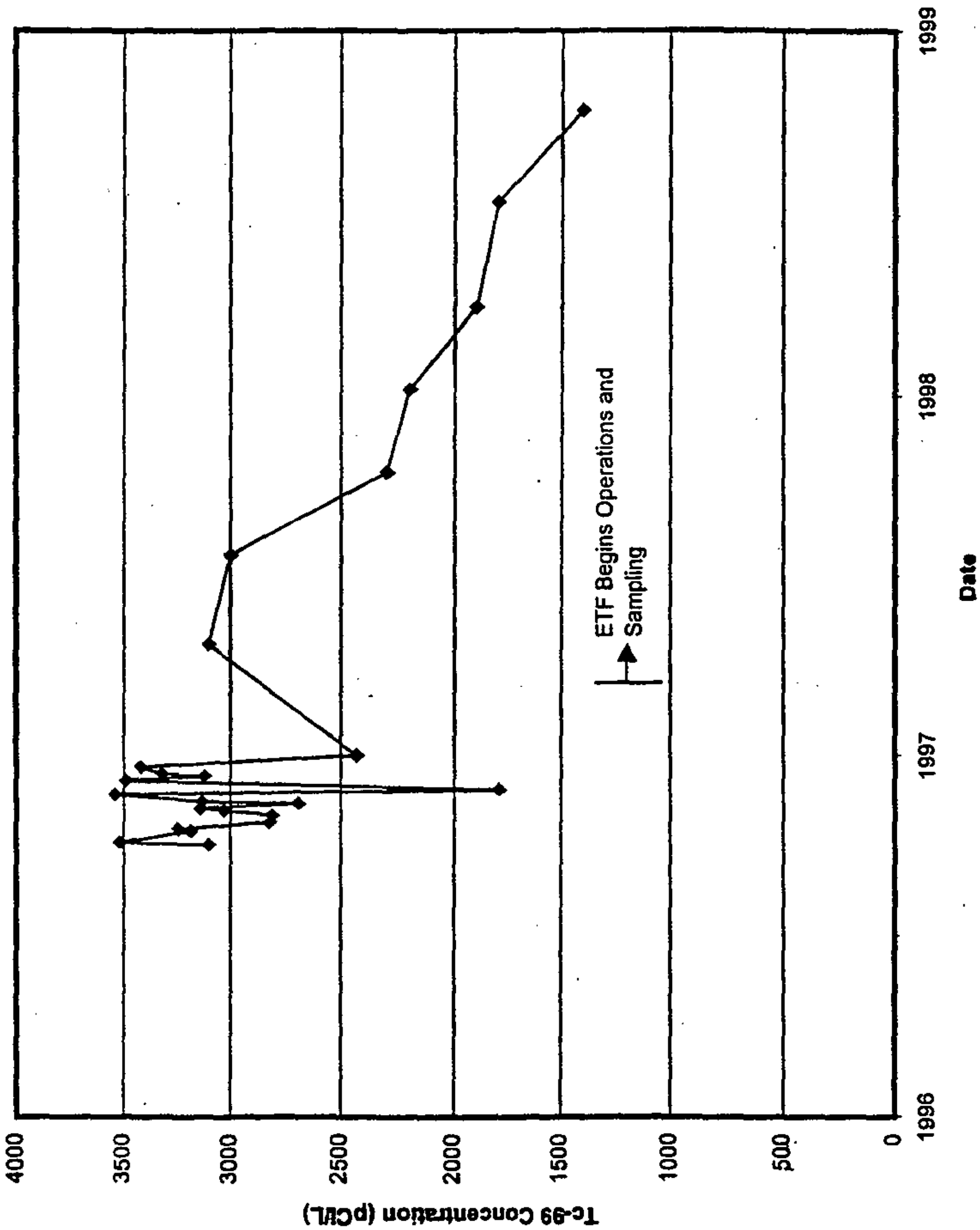
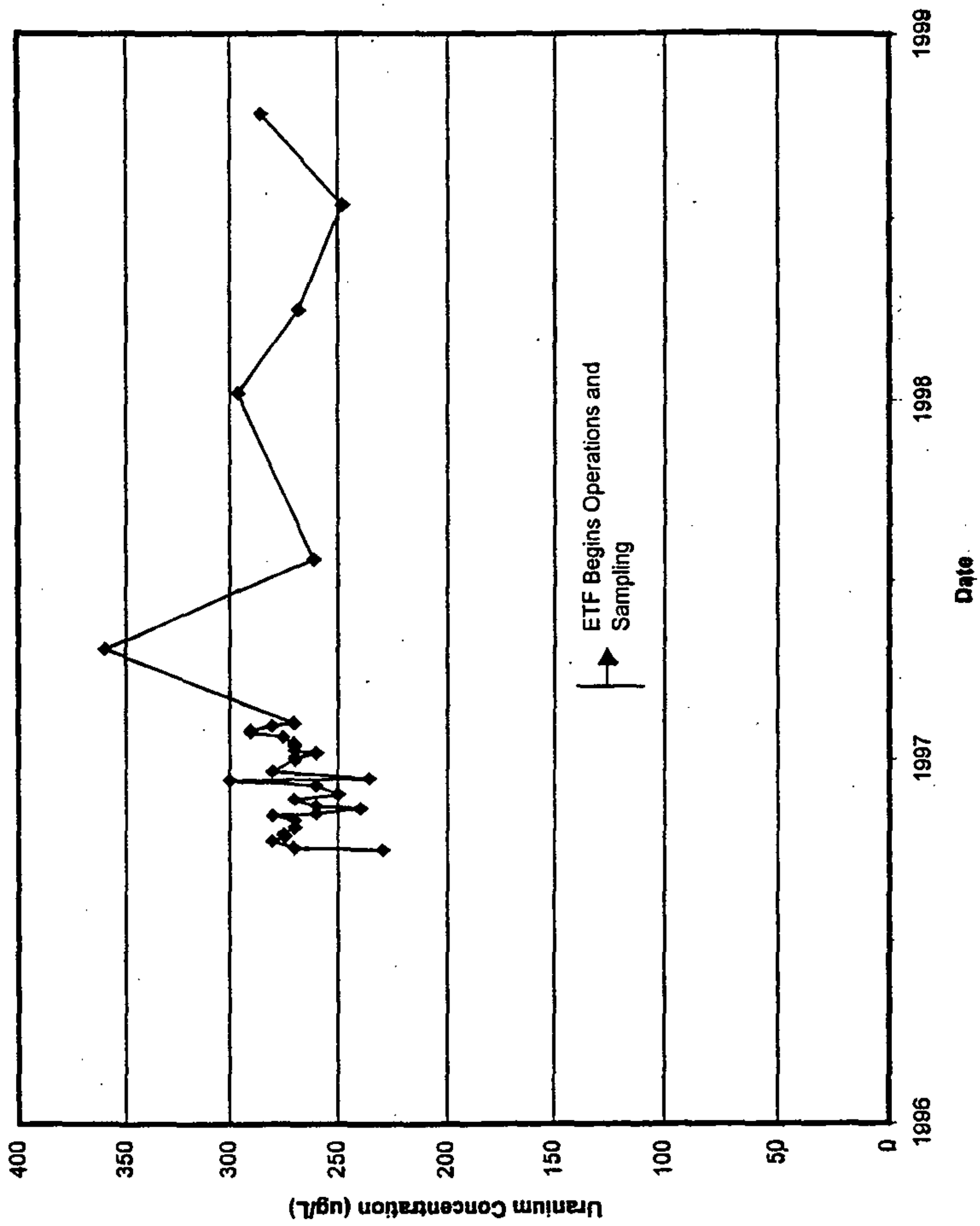


Figure 7 . Uranium Concentrations at Extraction Well 299-W19-39 Through December 31, 1998.



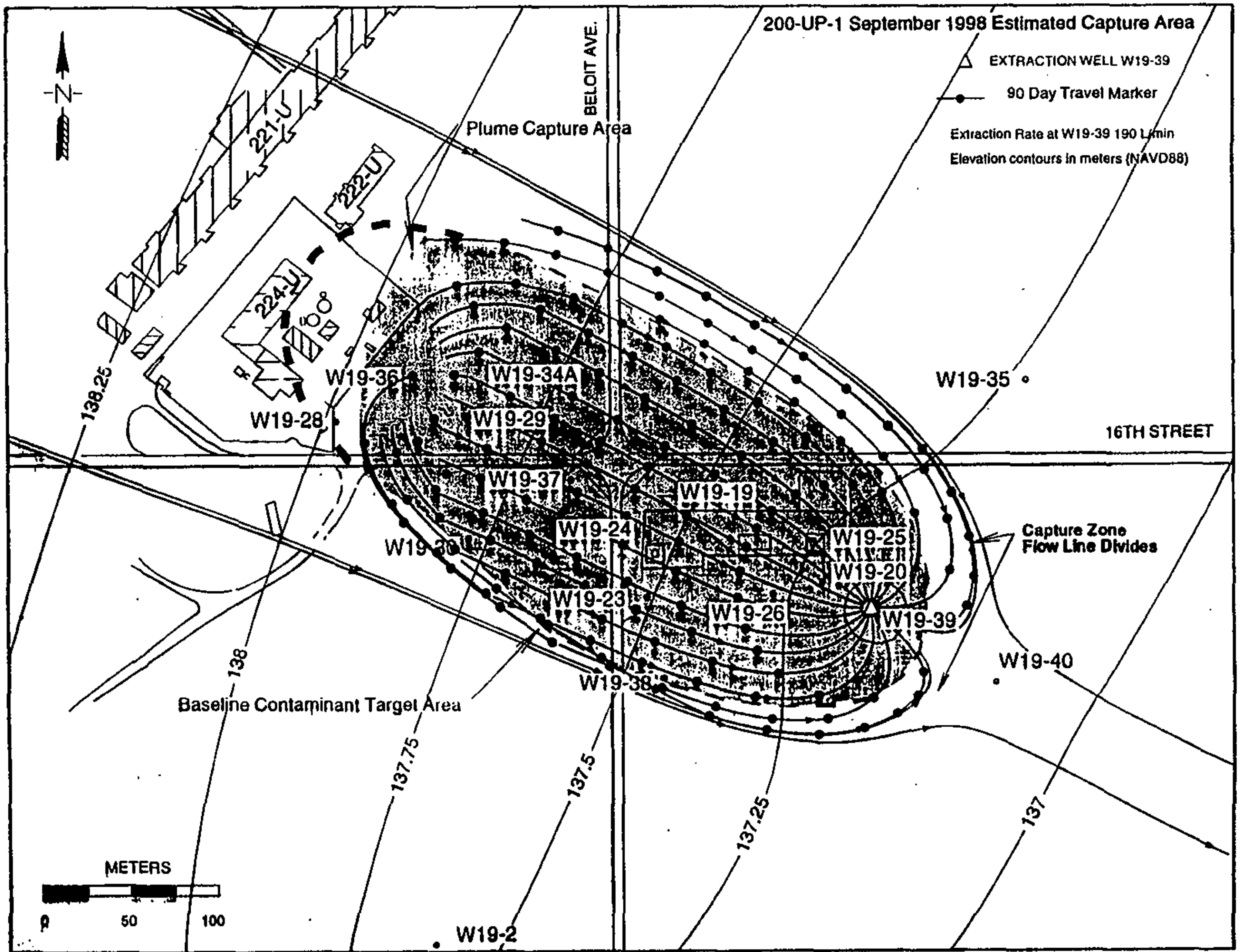


Figure 8. 200-UP-1 Area of Capture Through December 1998.

Figure 9. Simulated Technetium-99 Distribution for 2195 (T=200, K_d=0 mL/g).

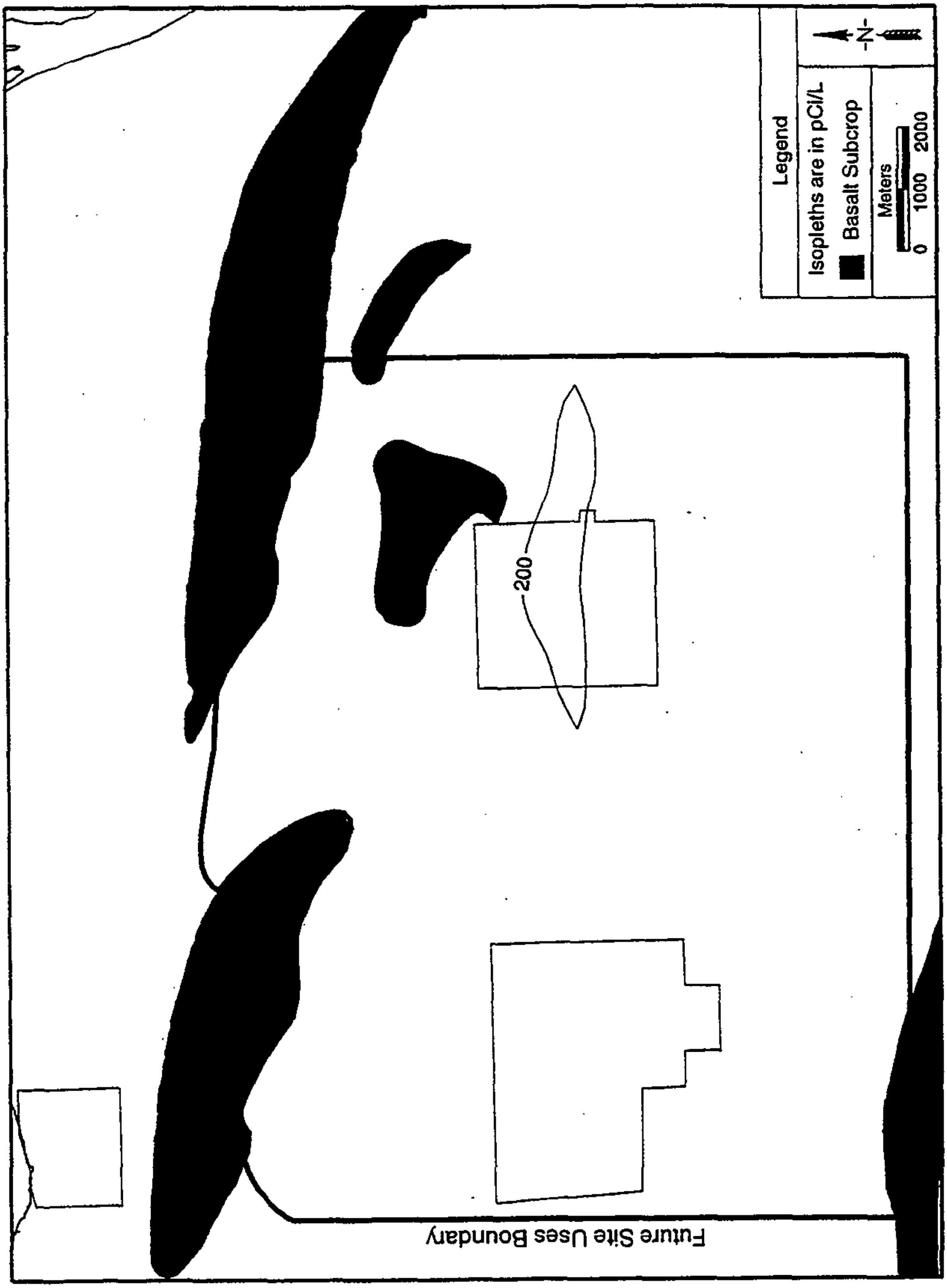


Figure 10 . Simulated Uranium Distribution for 2195 (T=200, K_d=0 mL/g).

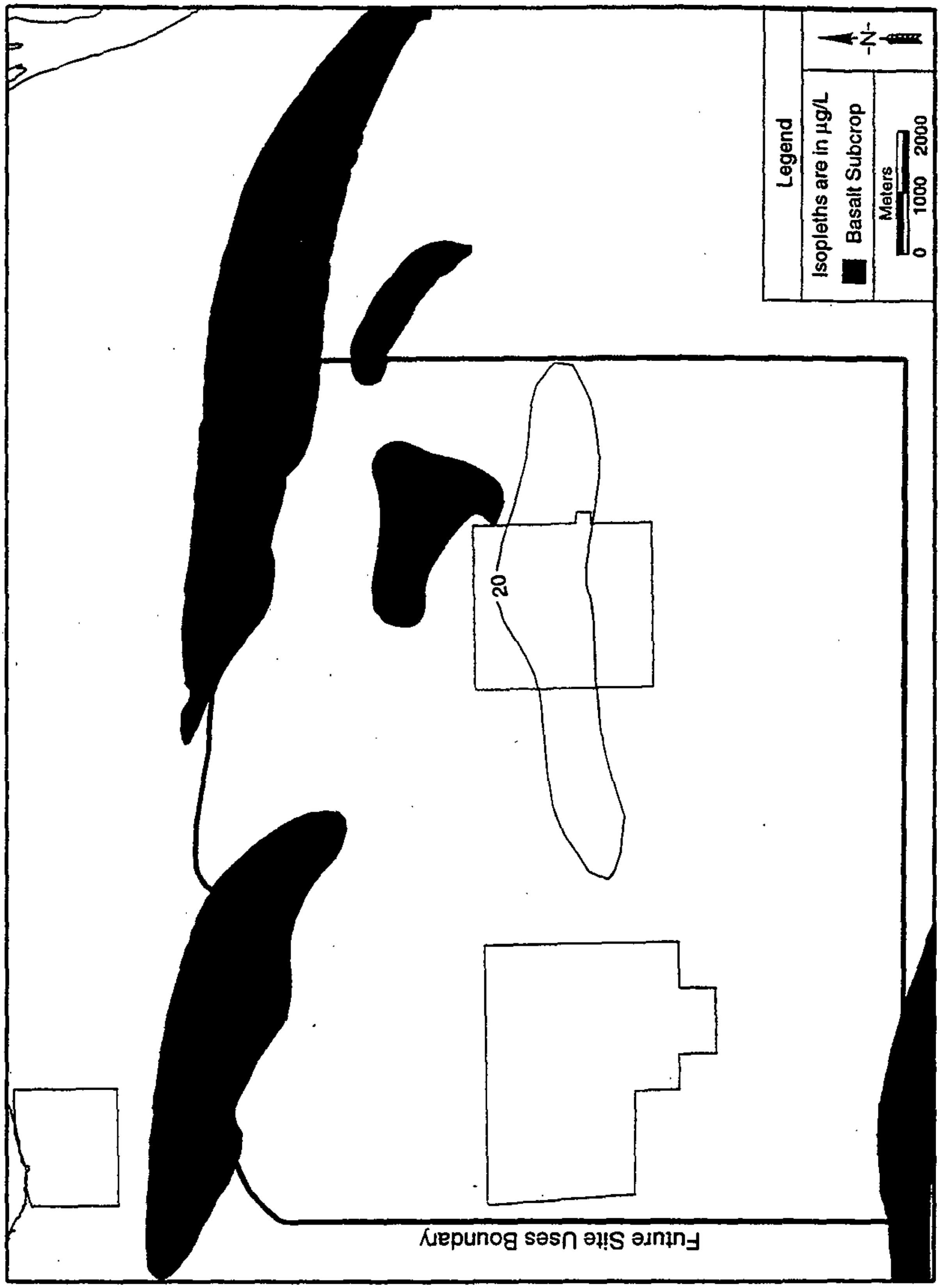


Figure 11. Simulated Uranium Distribution Under Remediation Scenario for 2195 (T=200, K_d=0 mL/g).

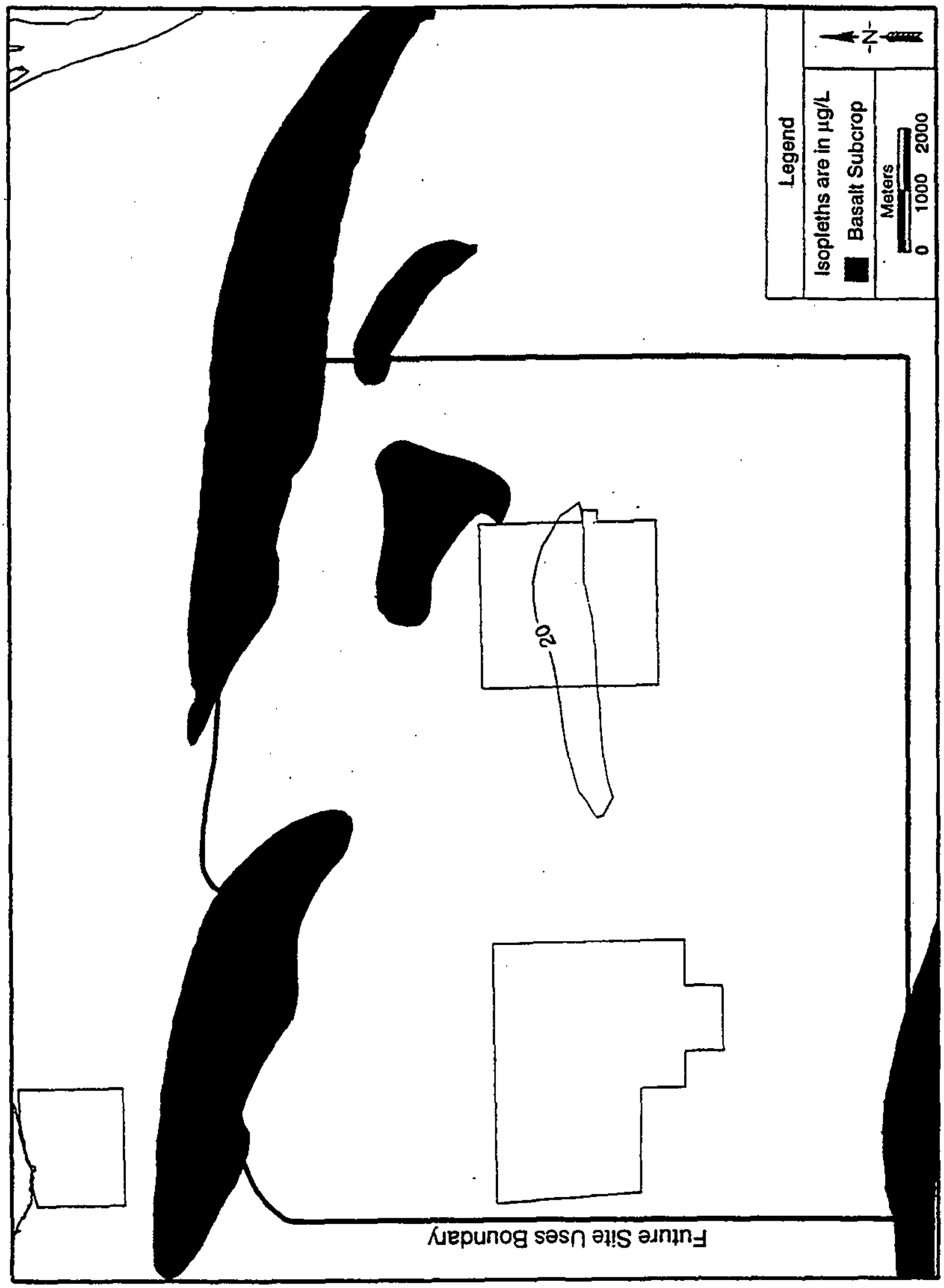


Figure 12 . Simulated Uranium Distribution for 2195 (T=200, K_d=0.5 mL/g).

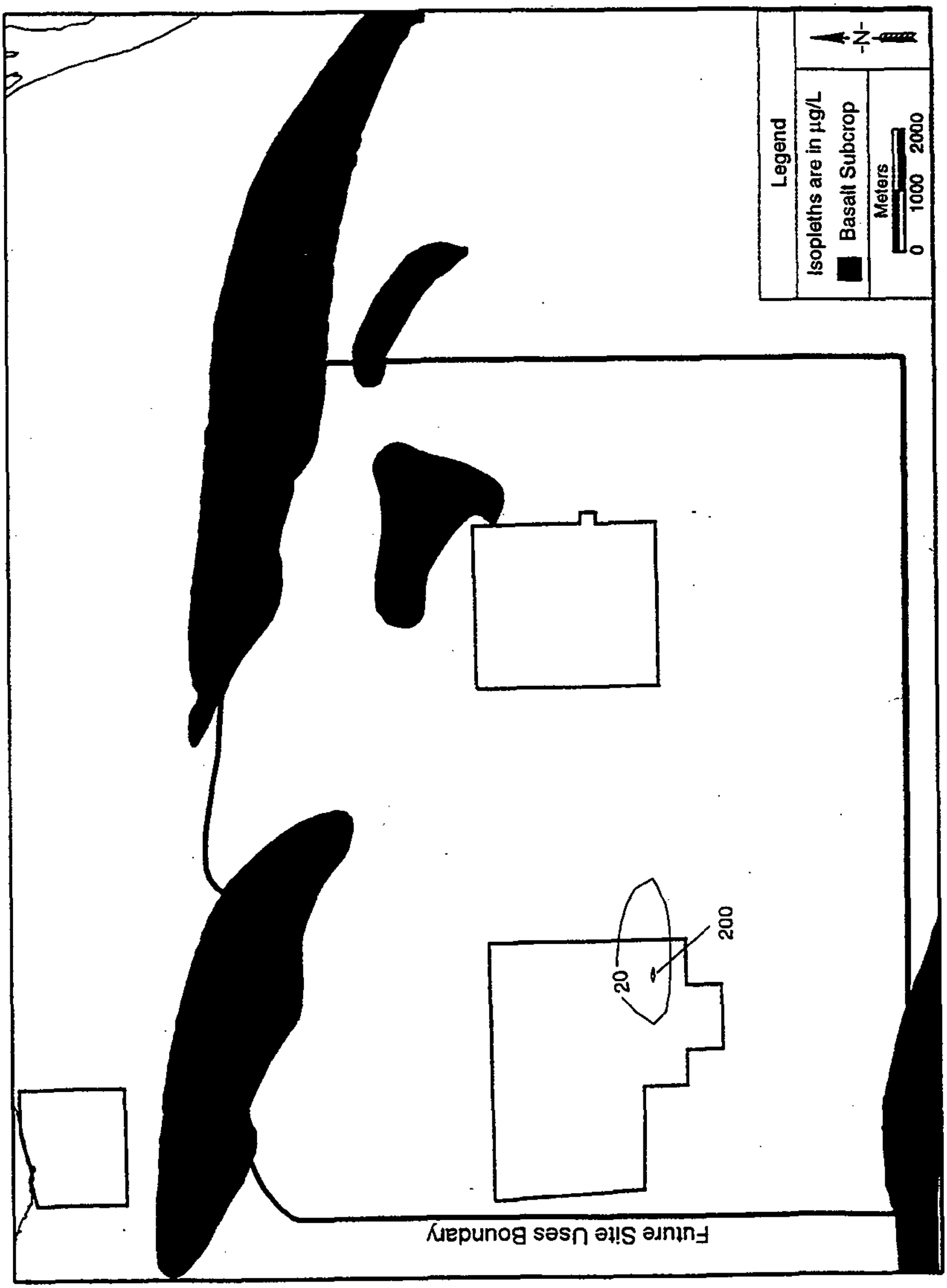


Table 1. Quantity of Treated Groundwater and Contaminant Mass Removed Since Initiation of 200-UP-1 Pump-and-Treat Operations.

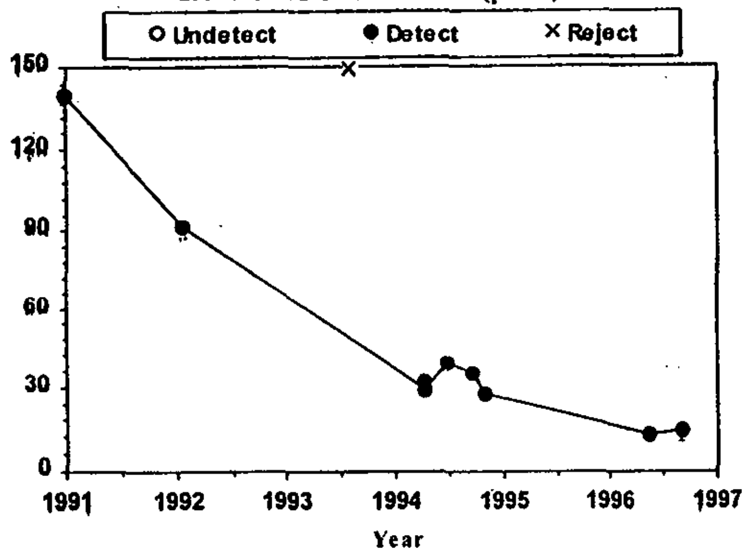
Reporting Period	Liters Treated	Mass Technetium-99 Removed (g)	Mass Total Uranium Removed (g)	Mass Carbon Tetrachloride Removed (g)	Mass Nitrate Removed (kg)
March 1994 - November 1994[a]	3,898,550	3.41	4,422	Not Reported	N/A
December 1994 - August 1995	11,391,491	7.79	9,831	992	N/A
September 1995 - November 1995	17,198,571	3.95	3,895	630	N/A
December 1995 - March 1996	31,311,340	9.05	9,105	1,609	N/A
April 1996 - June 1996	22,459,108	5.40	6,845	1,569	N/A
July 1996 - September 1996	22,370,327	4.01	5,134	2,790	N/A
October 1996 - December 1996	20,300,000	3.33	5,607	2,980	N/A
January 1997 - February 1997[b]	2,667,600	0.83	963	73	N/A
February - March 30, 1997	Shutdown	N/A	N/A	N/A	N/A
March 31 - September 30, 1997	32,414,481	5.6	11,000	888	2,260
October 1 - December 31, 1997	20,390,054	3.31	6,300	572	1,530
January 1 - March 31, 1998	19,791,765	2.08	4,900	460	1,070
April 1 - June 30, 1998	33,538,750	3.58	8,680	907	2,150
July 1 - September 30, 1998	26,346,466	1.57	3,750	296	900
October 1 – December 31, 1998	22,174,396	1.49	4,910	341	979
Total	**360,587,433**	**55.4**	**85,342**	**14,107**	**8,889**

[a] Data from the treatability test as reported in *Treatability Report for the 200-UP-1 Operable Unit - Hanford Site* (DOE-RL 1995).
[b] Estimated values based on 189 L/min (50 gal/min) flow, running 24 hours/day, at 97.5% efficiency.
N/A = not applicable

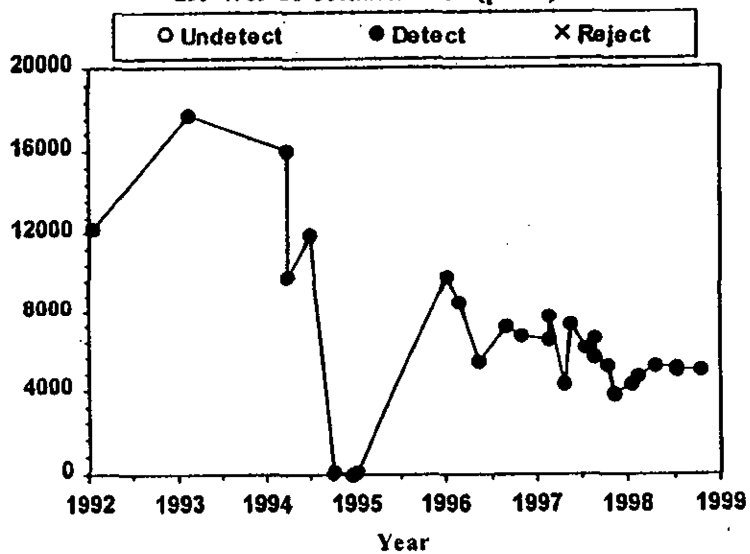
APPENDIX A

200-UP-1 CONTAMINANT TREND PLOTS

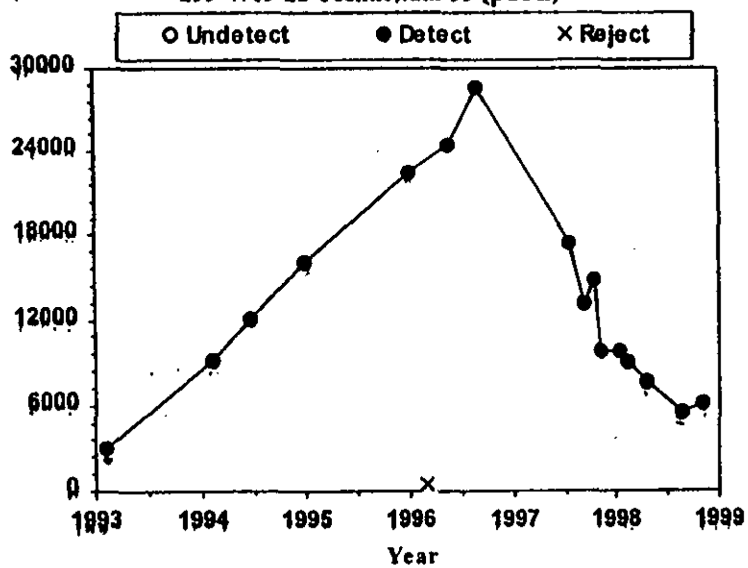
299-W19-18 Technetium-99 (pCi/L)



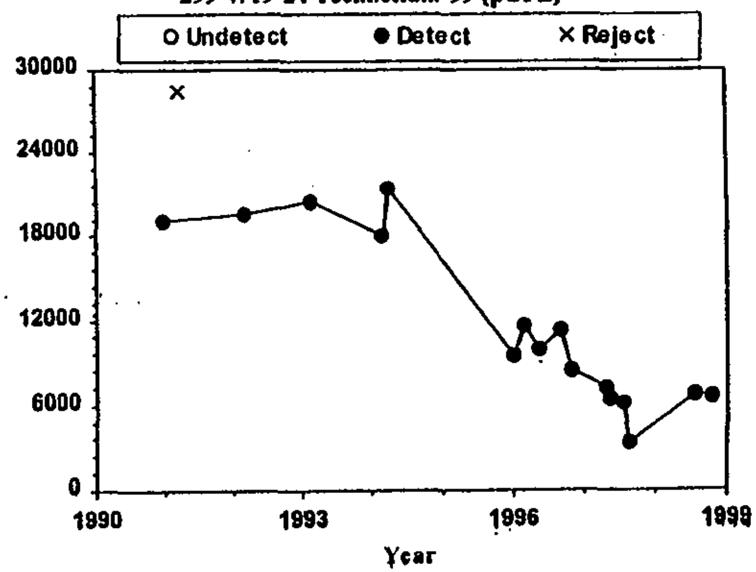
299-W19-20 Technetium-99 (pCi/L)

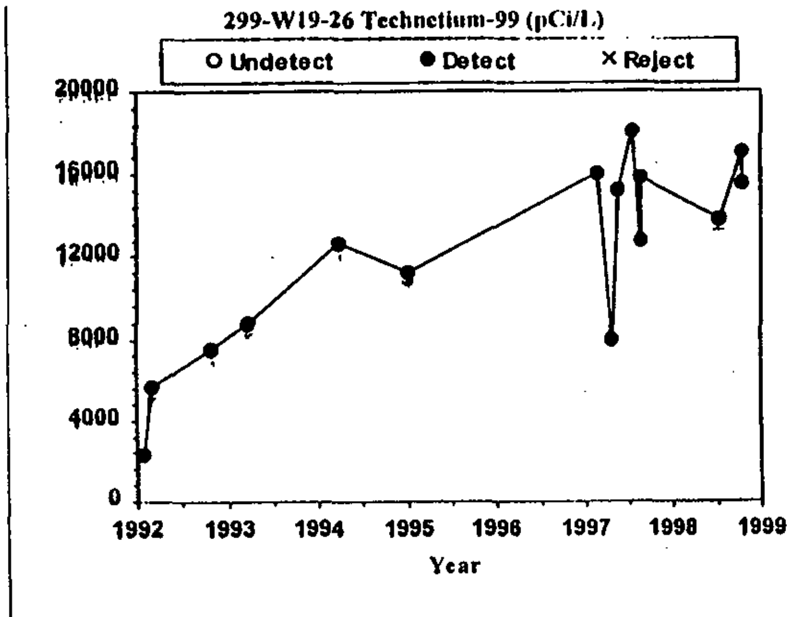


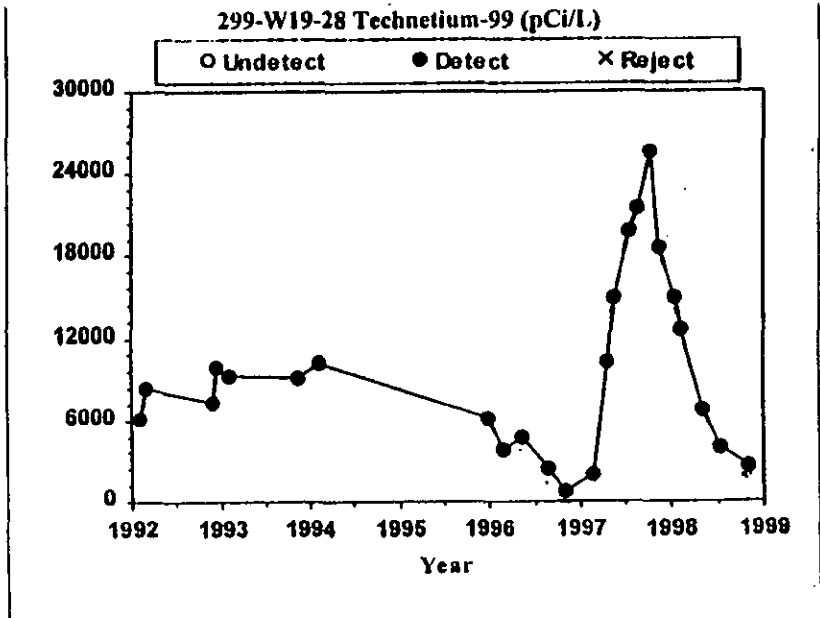
299-W19-23 Technetium-99 (pCi/L)

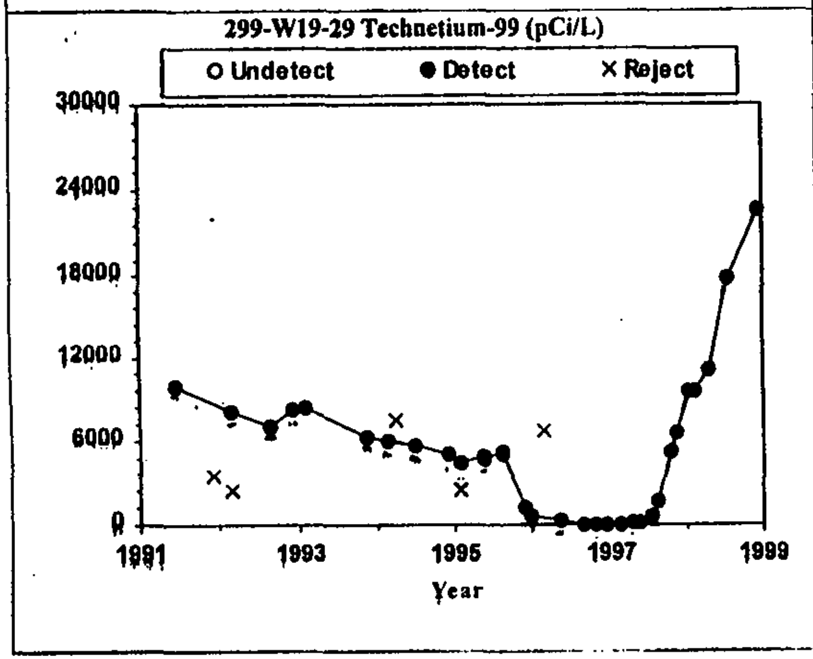


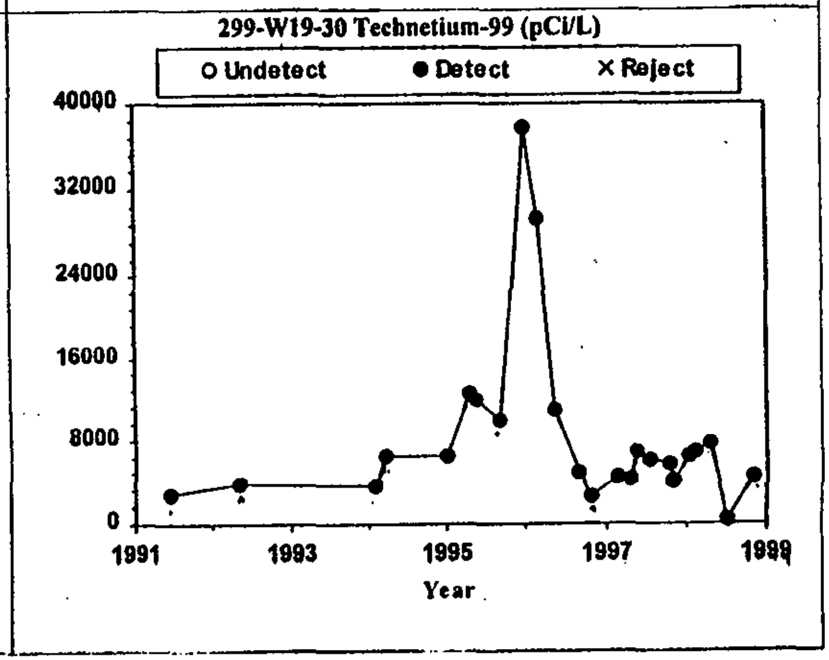
299-W19-24 Technetium-99 (pCi/L)



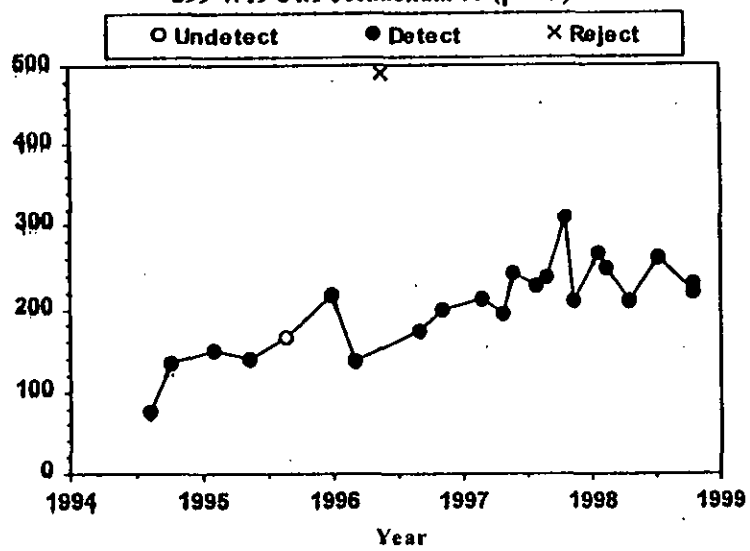

299-W19-26 Technetium-99 (pCi/L)
O Undetect
● Detect
× Reject
20000
16000
12000
8000
4000
0
1992
1993
1994
1995
1996
1997
1998
1999
Year


299-W19-28 Technetium-99 (pCi/L)
O Undetect
● Detect
× Reject
30000
24000
18000
12000
6000
0
1992
1993
1994
1995
1996
1997
1998
1999
Year

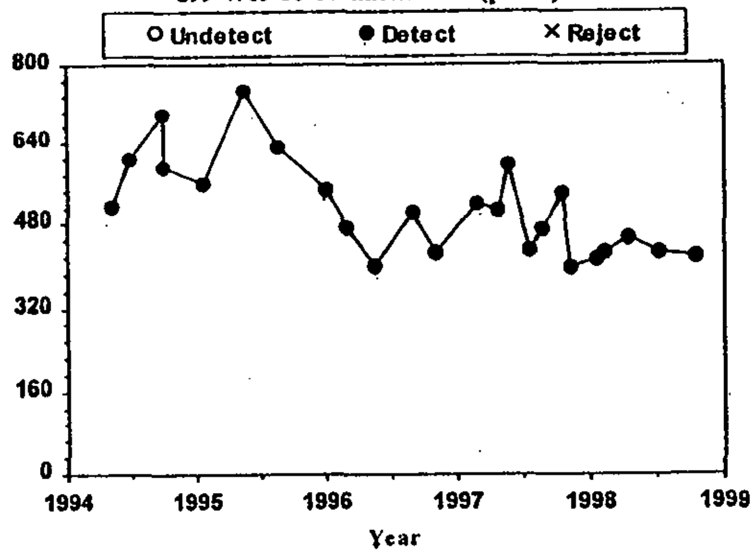

299-W19-29 Technetium-99 (pCi/L)
O Undetect
● Detect
× Reject
30000
24000
18000
12000
6000
0
1991
1993
1995
1997
1999
Year


299-W19-30 Technetium-99 (pCi/L)
O Undetect
● Detect
× Reject
40000
32000
24000
16000
8000
0
1991
1993
1995
1997
1999
Year

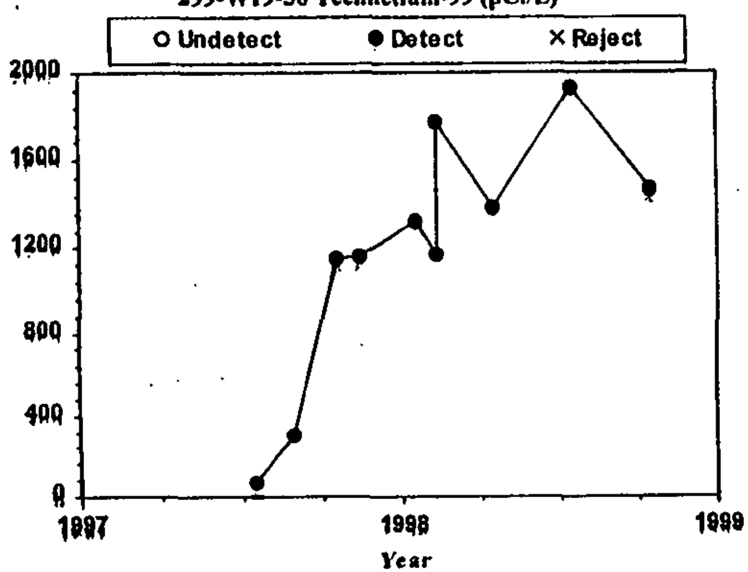
299-W19-34A Technetium-99 (pCi/L)



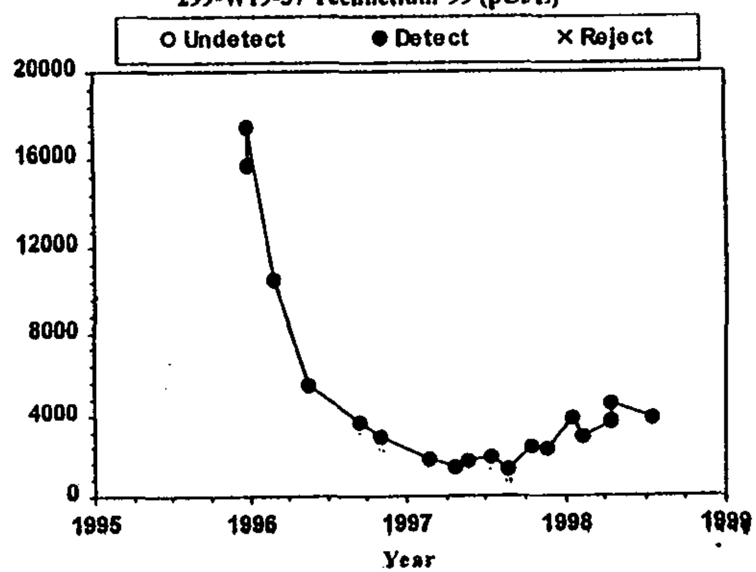
299-W19-35 Technetium-99 (pCi/L)



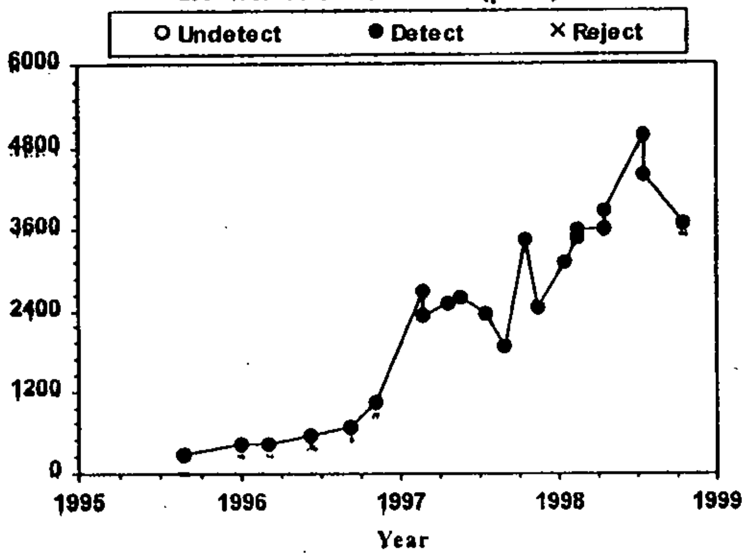
299-W19-36 Technetium-99 (pCi/L)



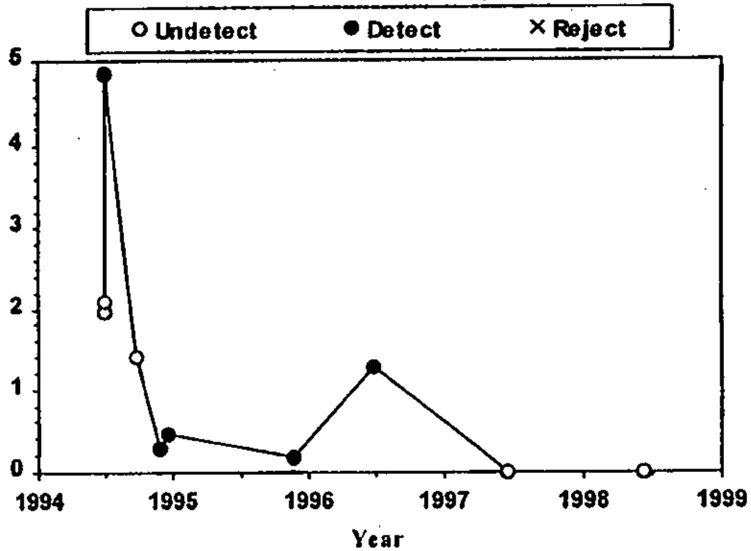
299-W19-37 Technetium-99 (pCi/L)



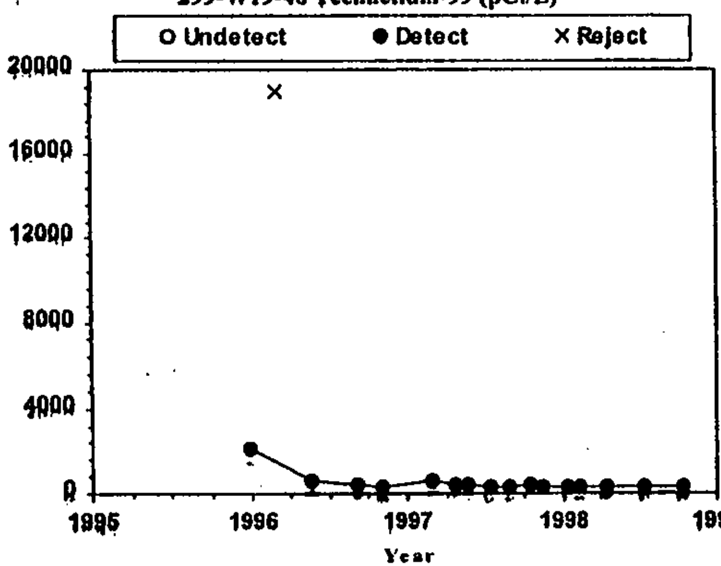
299-W19-38 Technetium-99 (pCi/L)



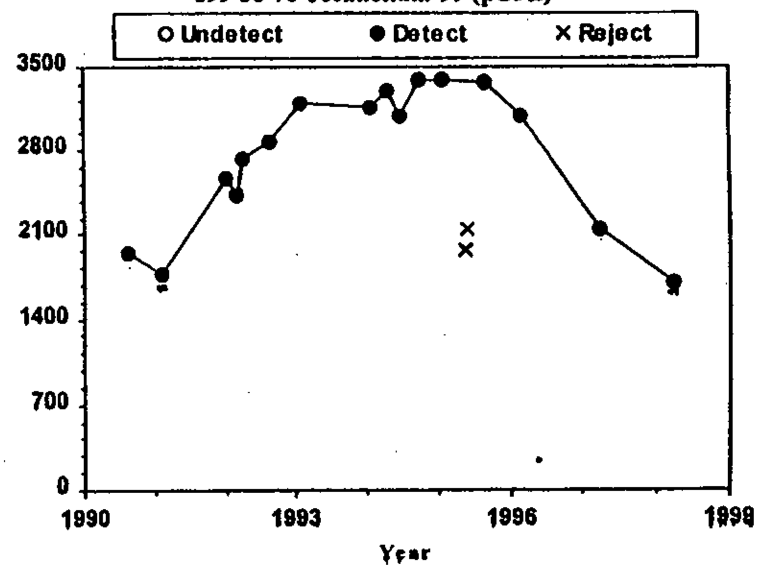
299-W19-4 Technetium-99 (pCi/L)



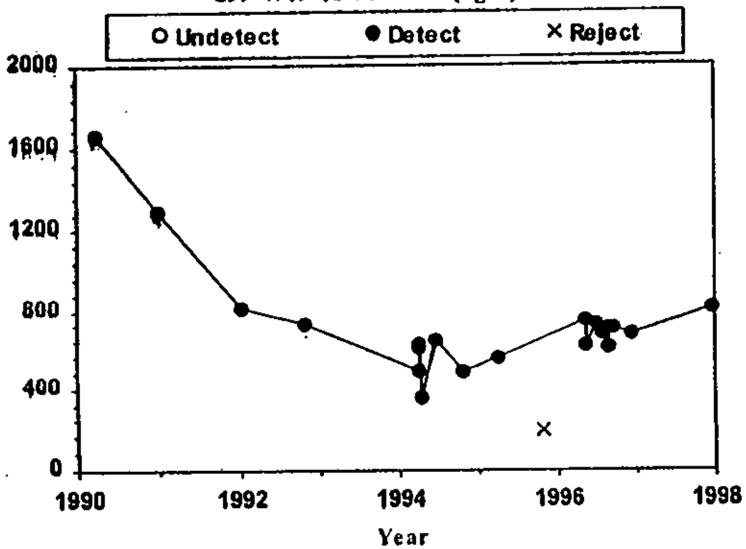
299-W19-40 Technetium-99 (pCi/L)



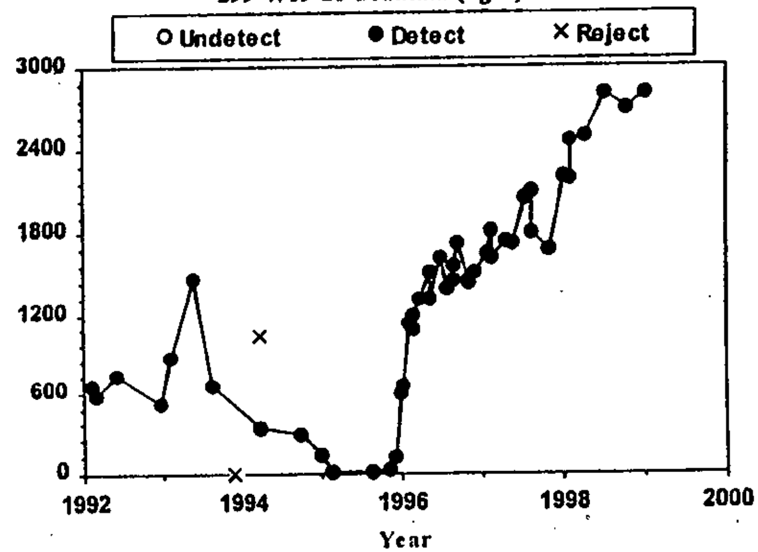
699-38-70 Technetium-99 (pCi/L)



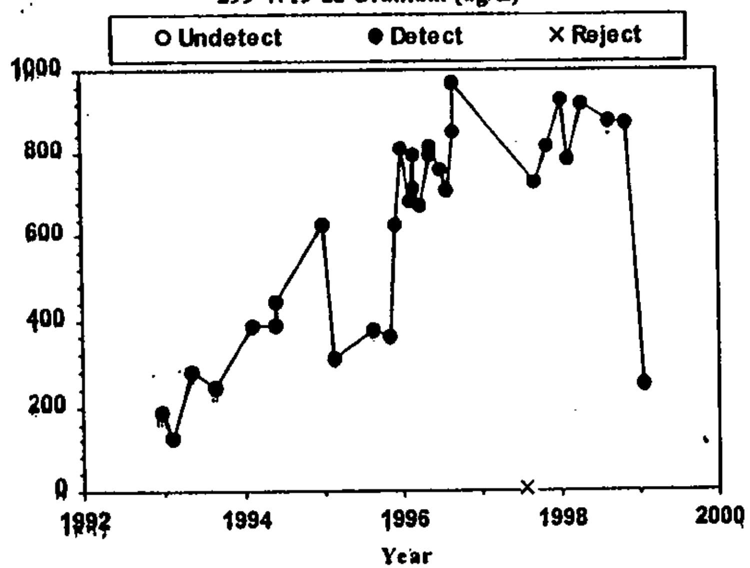
299-W19-18 Uranium (ug/L)



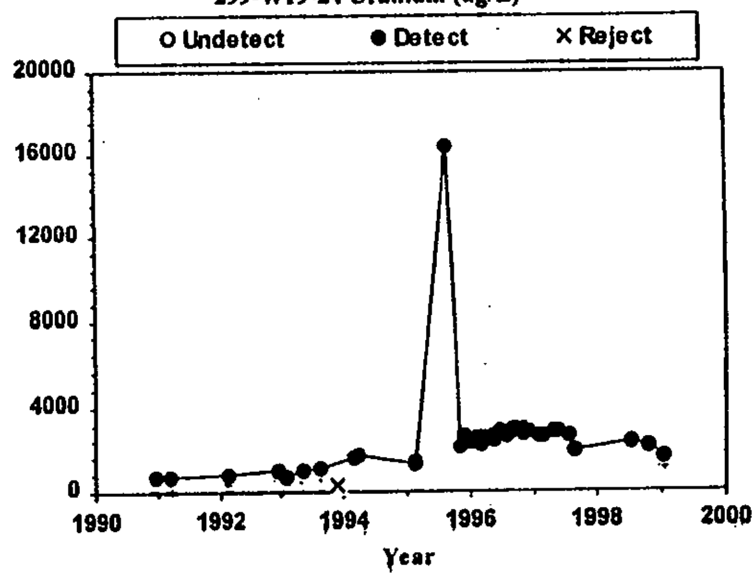
299-W19-20 Uranium (ug/L)



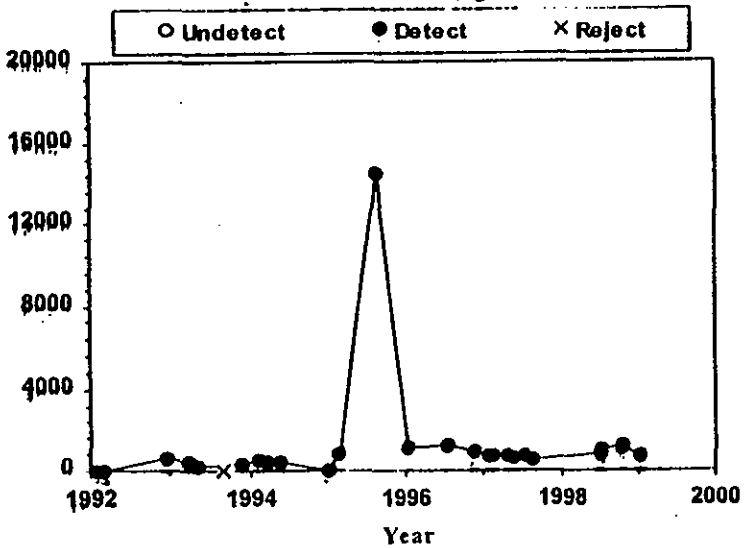
299-W19-23 Uranium (ug/L)



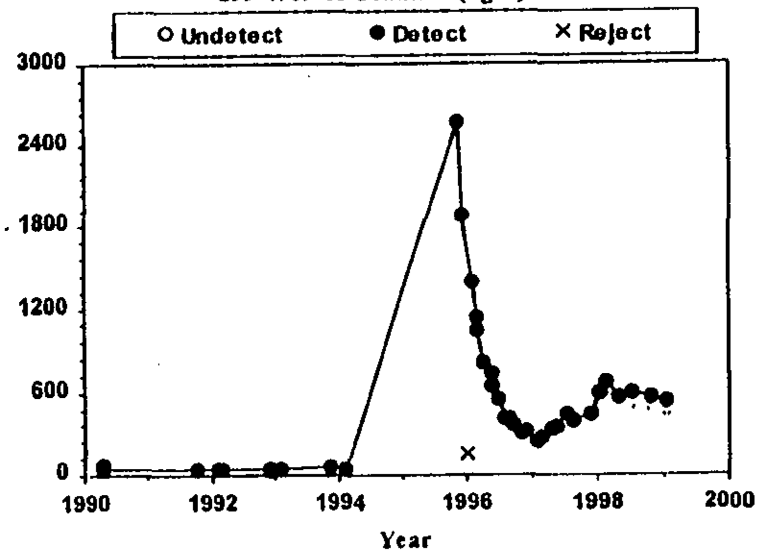
299-W19-24 Uranium (ug/L)



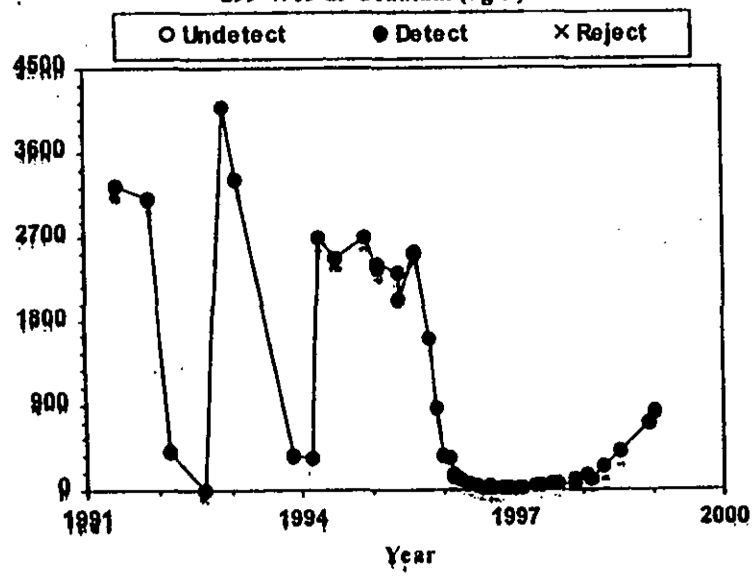
299-W19-26 Uranium (ug/L)



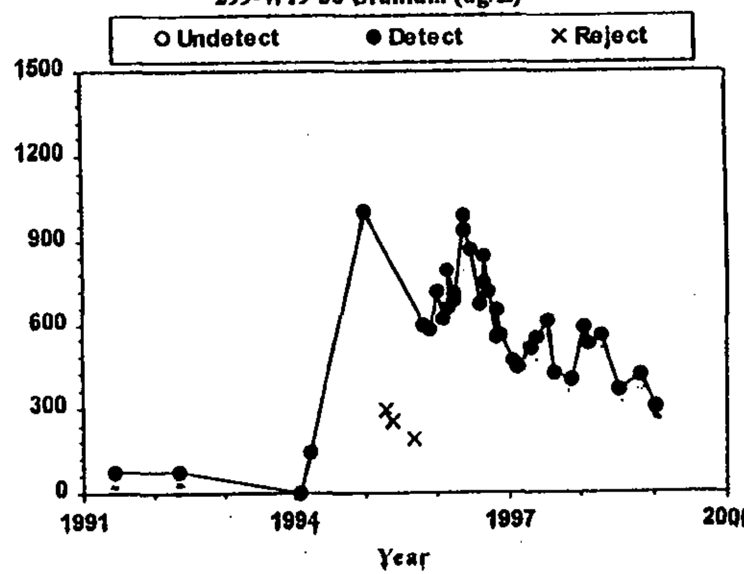
299-W19-28 Uranium (ug/L)

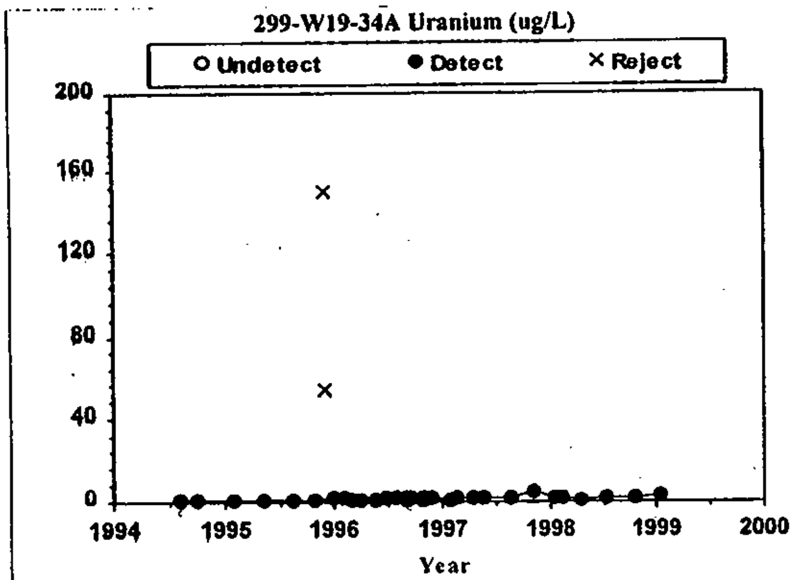


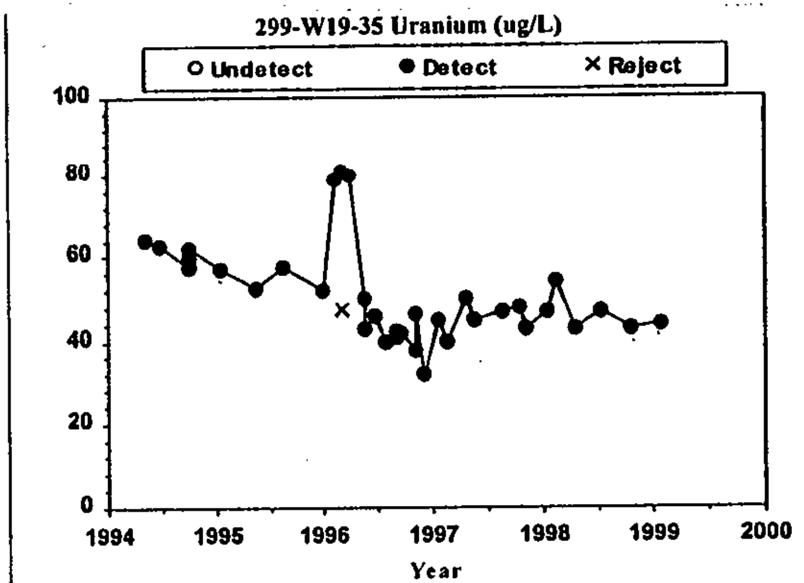
299-W19-29 Uranium (ug/L)



299-W19-30 Uranium (ug/L)




299-W19-34A Uranium (ug/L)
O Undetect ● Detect × Reject
200
160
120
80
40
0
1994 1995 1996 1997 1998 1999 2000
Year


299-W19-35 Uranium (ug/L)
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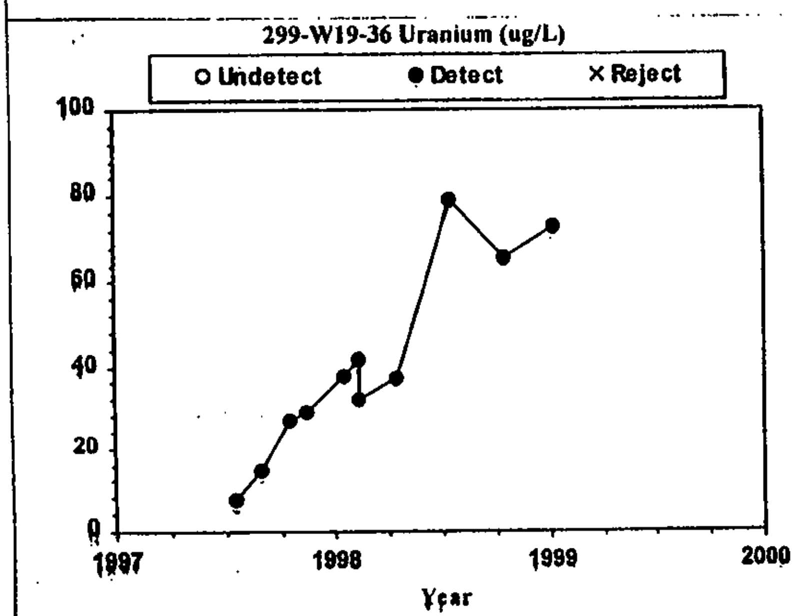
100
80
60
40
20
0
1994 1995 1996 1997 1998 1999 2000
Year


299-W19-36 Uranium (ug/L)
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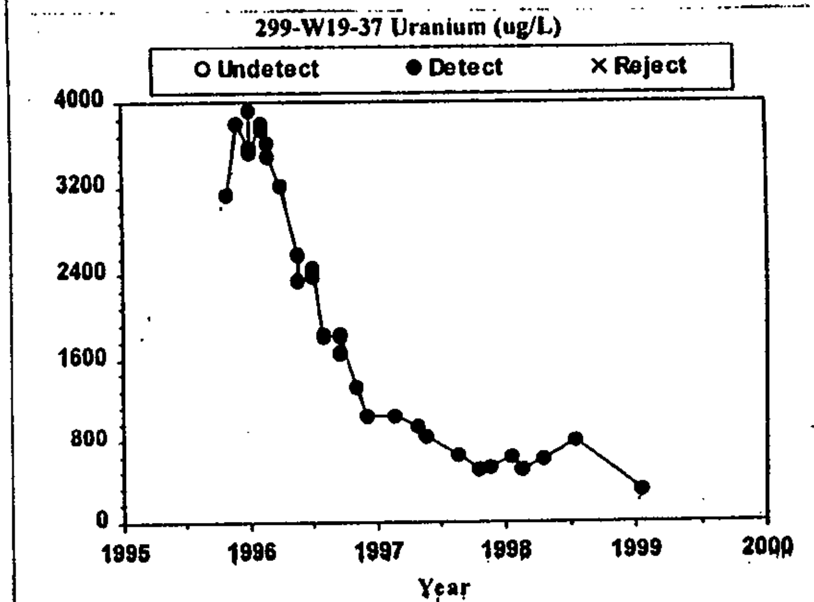
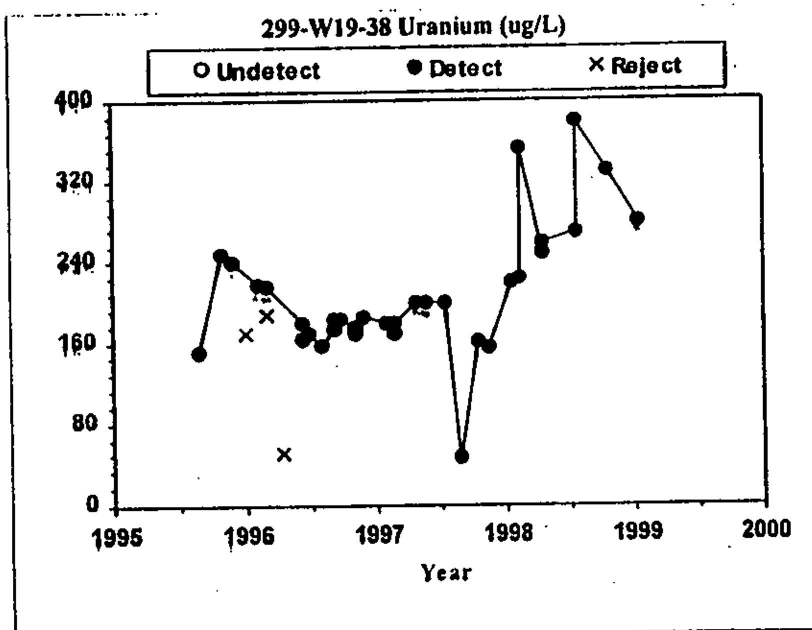
80
60
40
20
0
1997 1998 1999 2000
Year


299-W19-37 Uranium (ug/L)
O Undetect ● Detect × Reject
4000
3200
2400
1600
800
0
1995 1996 1997 1998 1999 2000
Year


299-W19-38 Uranium (ug/L)
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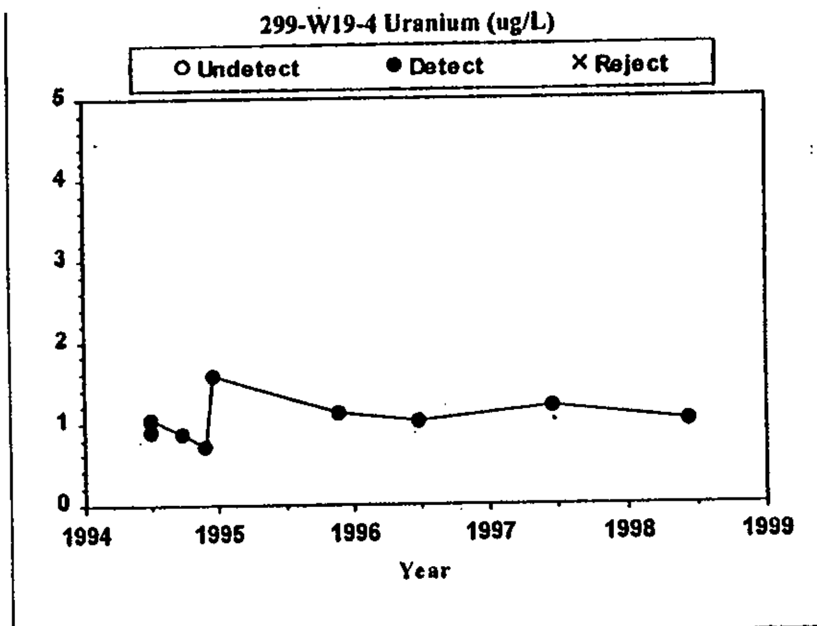
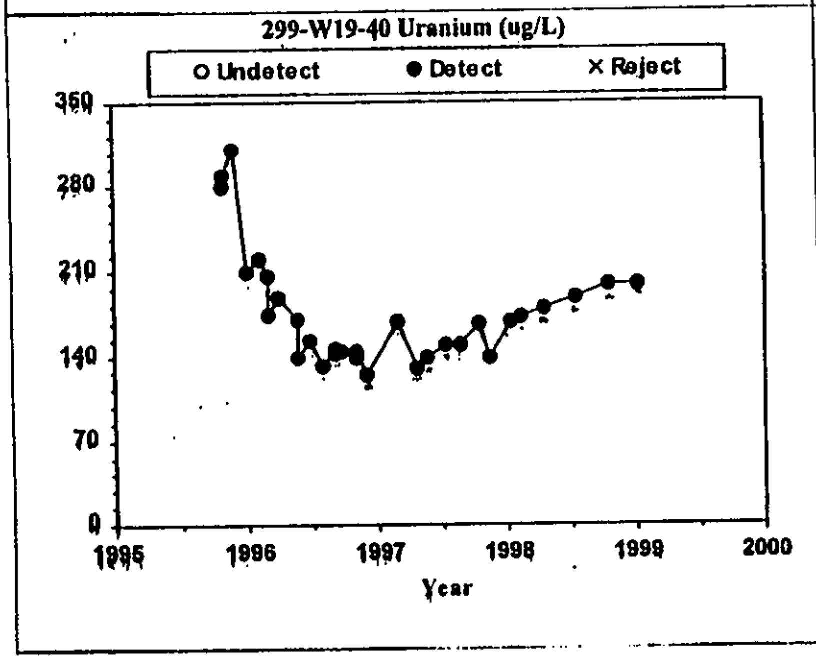
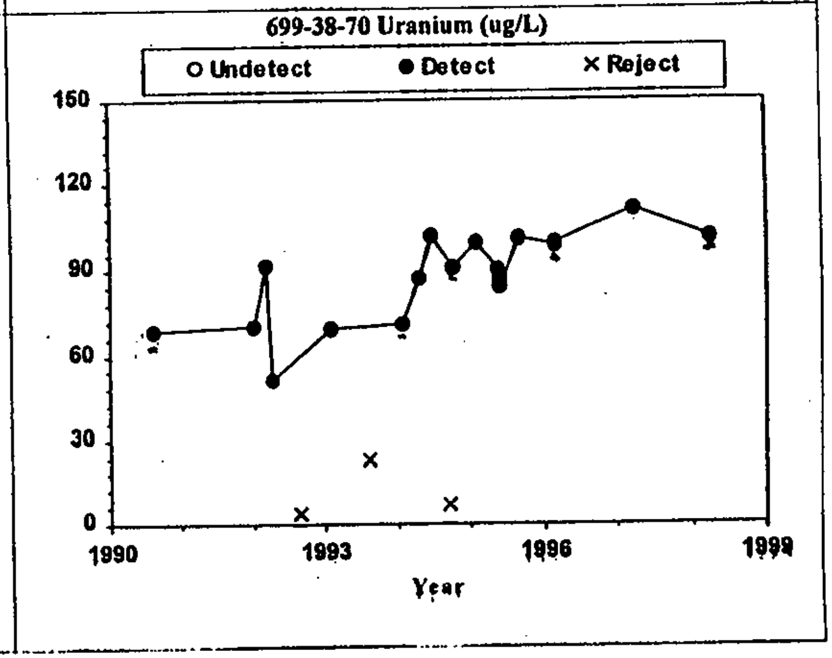
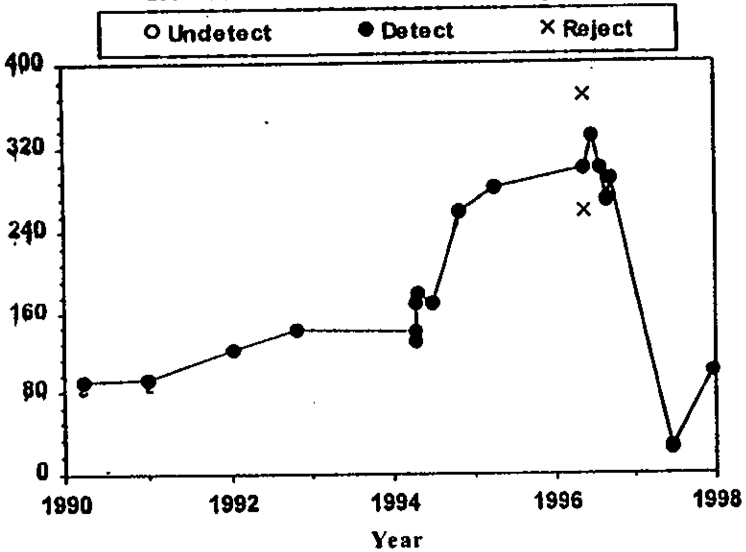
● Detect
× Reject
400
320
240
160
80
0
1995
1996
1997
1998
1999
2000
Year


299-W19-4 Uranium (ug/L)
O Undetect
● Detect
× Reject
5
4
3
2
1
0
1994
1995
1996
1997
1998
1999
Year

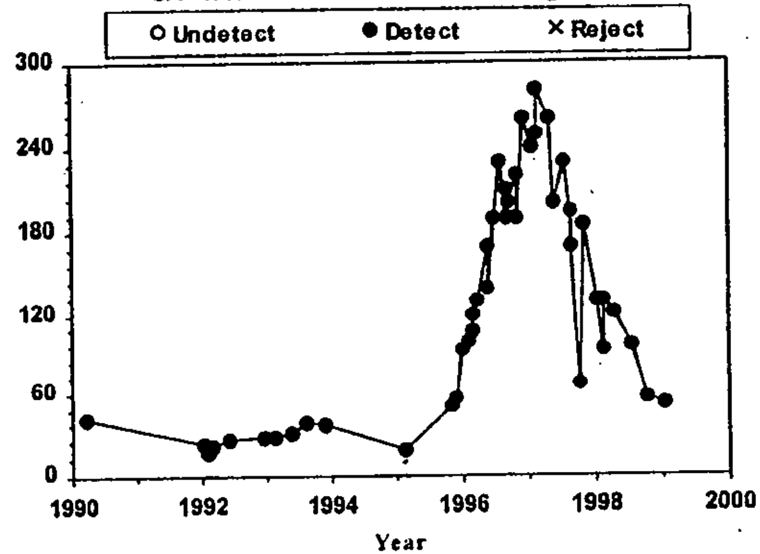

299-W19-40 Uranium (ug/L)
O Undetect
● Detect
× Reject
350
280
210
140
70
0
1995
1996
1997
1998
1999
2000
Year


699-38-70 Uranium (ug/L)
O Undetect
● Detect
× Reject
150
120
90
60
30
0
1990
1993
1996
1999
Year

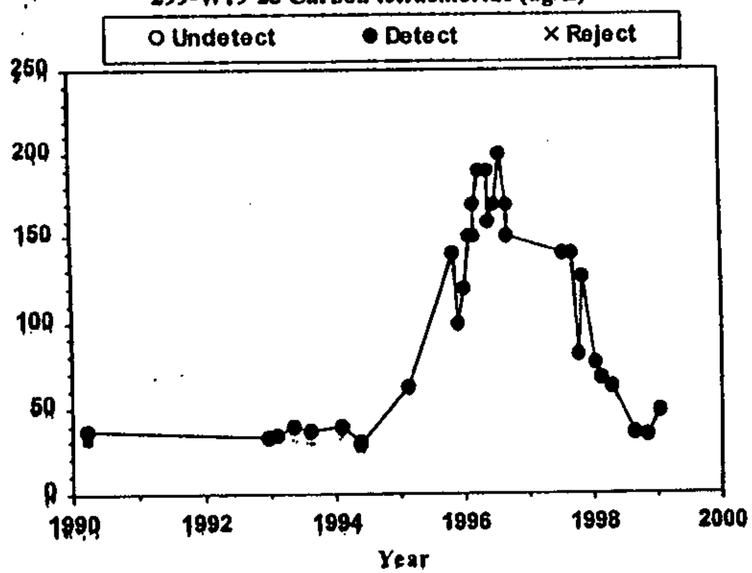
299-W19-18 Carbon tetrachloride (ug/L)



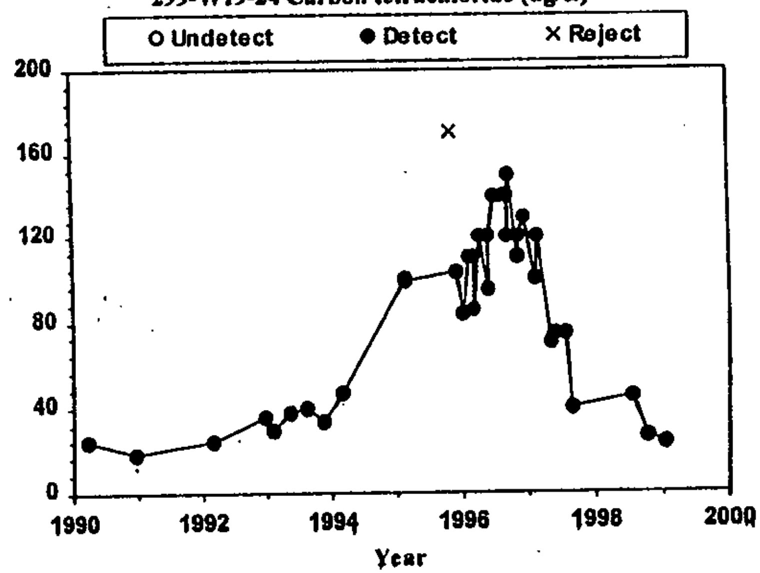
299-W19-20 Carbon tetrachloride (ug/L)



299-W19-23 Carbon tetrachloride (ug/L)

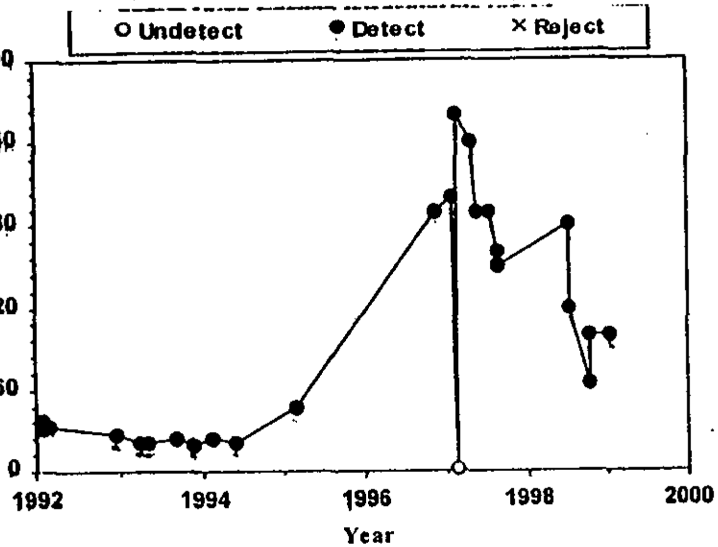


299-W19-24 Carbon tetrachloride (ug/L)

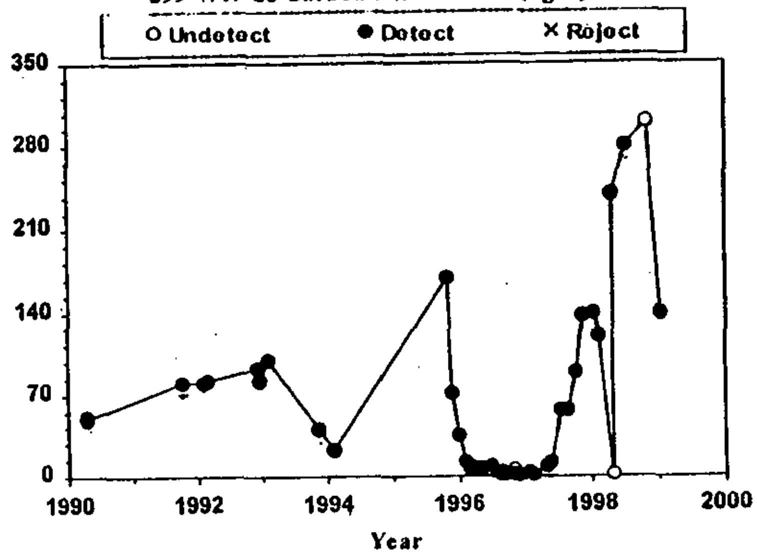


Attachment 12

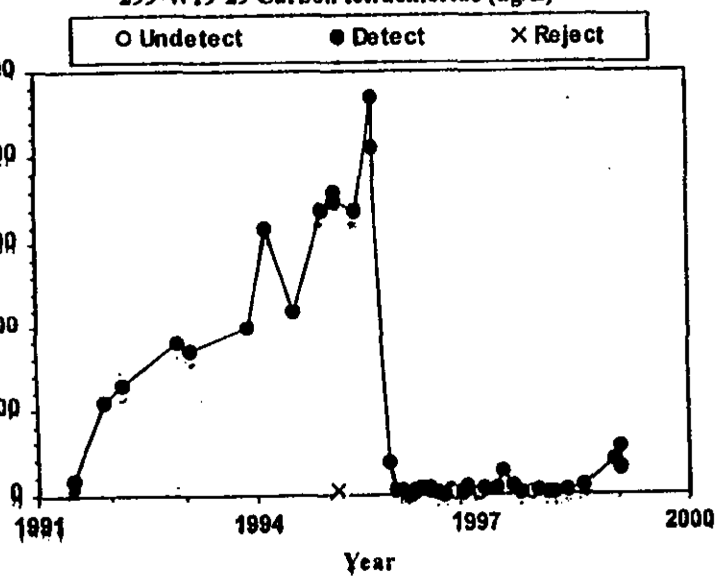
299-W19-26 Carbon tetrachloride (ug/L)



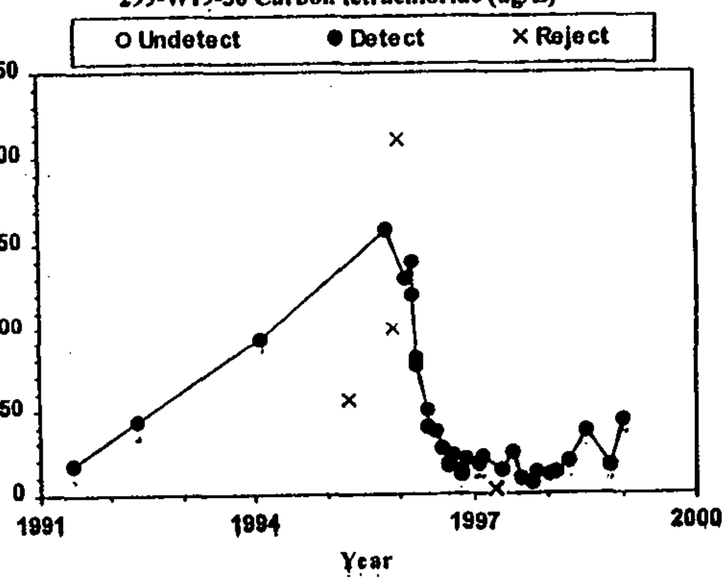
299-W19-28 Carbon tetrachloride (ug/L)

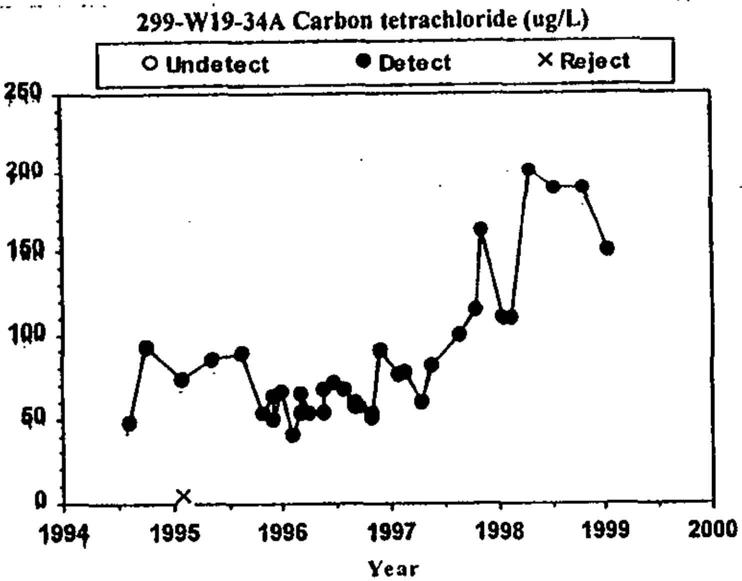


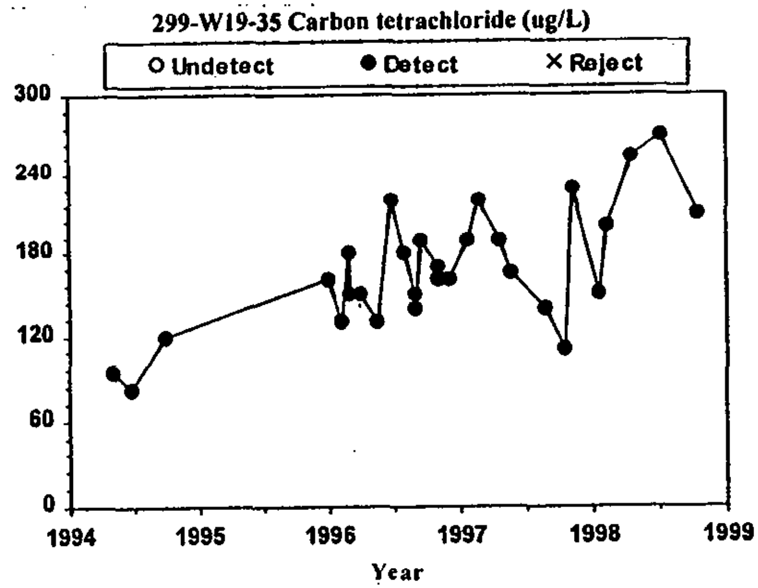
299-W19-29 Carbon tetrachloride (ug/L)

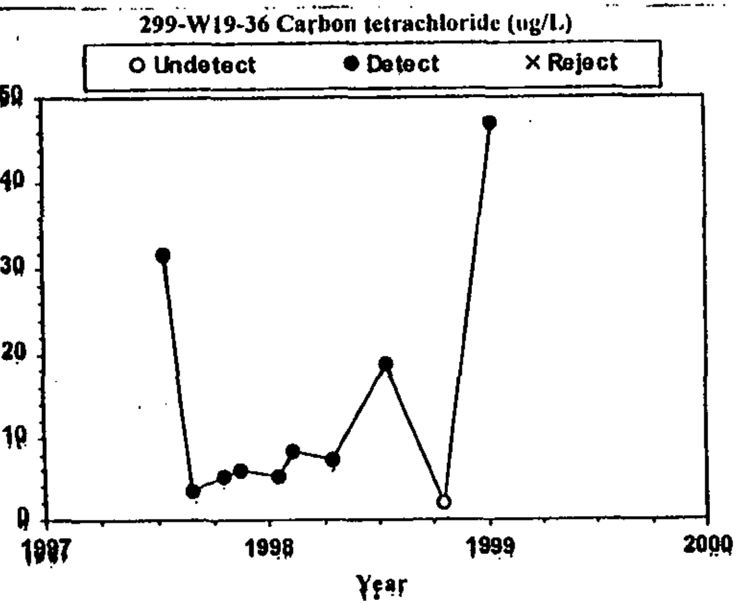


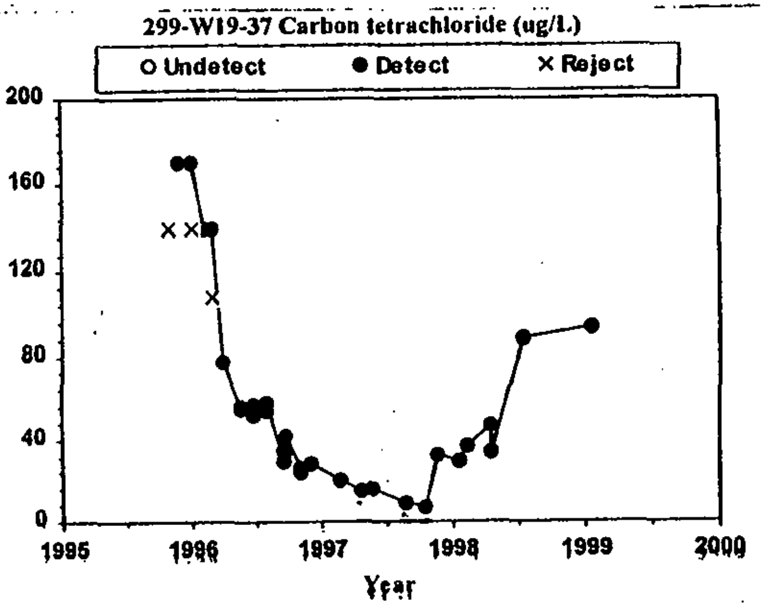
299-W19-30 Carbon tetrachloride (ug/L)











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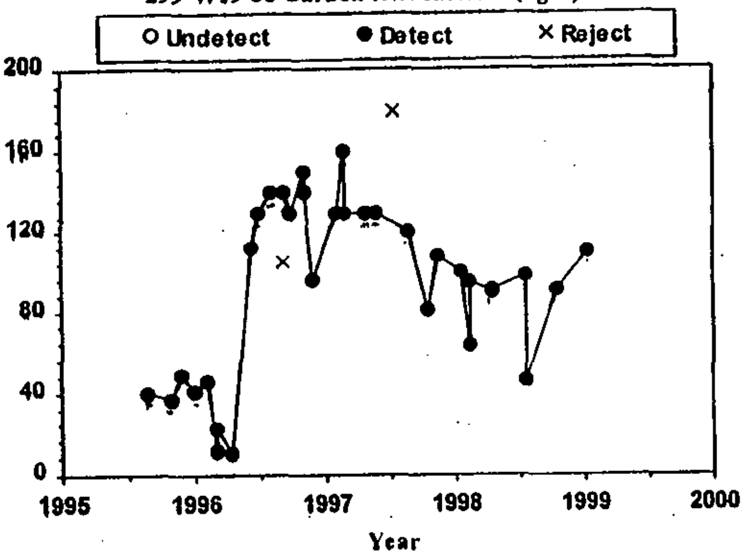
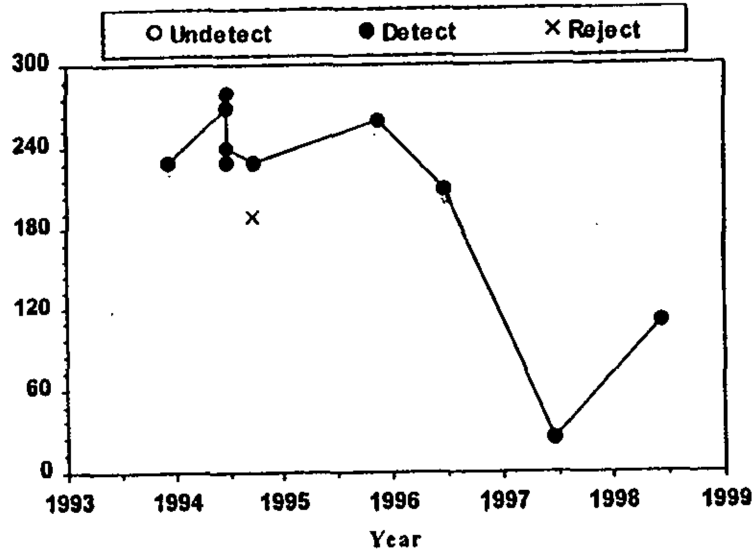
Attachment 12

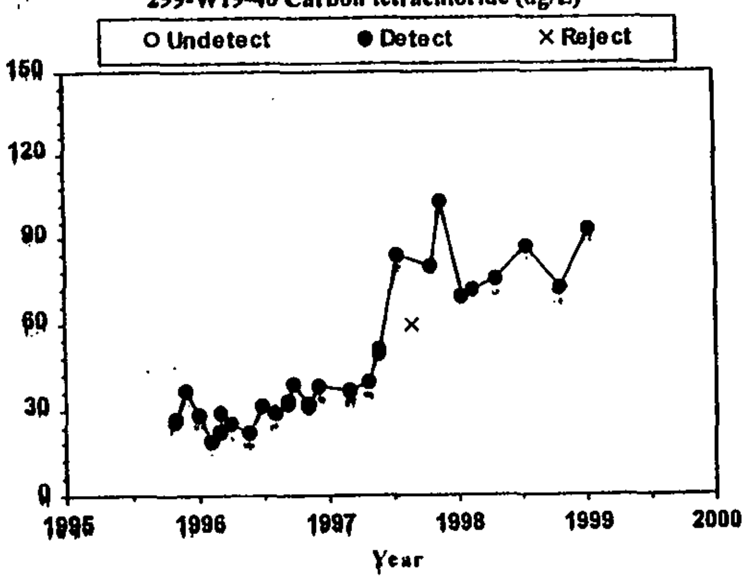
299-W19-38 Carbon tetrachloride (ug/L)



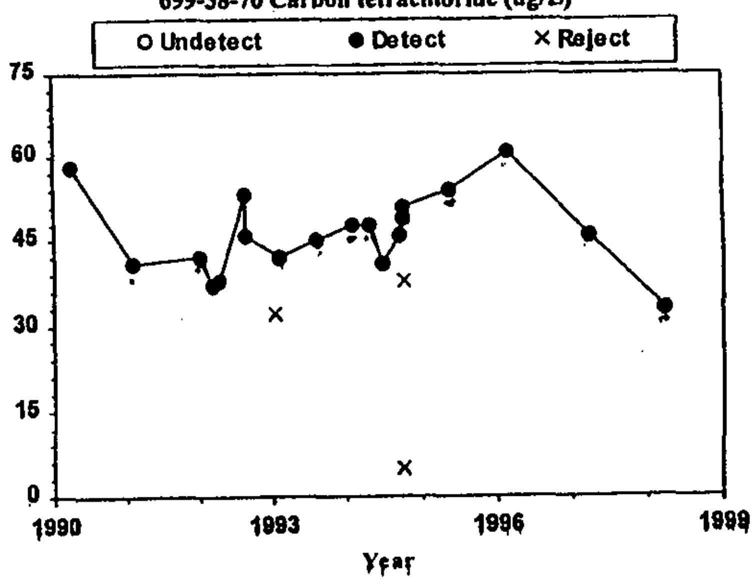
299-W19-4 Carbon tetrachloride (ug/L)



299-W19-40 Carbon tetrachloride (ug/L)



699-38-70 Carbon tetrachloride (ug/L)



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Attachment 12

Carlson, Richard A

From: Einan, David R
Sent: Thursday, March 25, 1999 2:03 PM
To: McLeod, Robert G (Bob); James, Jeff R; Post, Thomas C; Carlson, Richard A
Subject: ETF

Gentlemen:

I recieved confirmation from Ecology (Dave Dougherty) that ETF is (and has been) in compliance with its discharge permit. Therefore, the shipment of the drums from Landfill 1d to ETF is approved.

Dave Einan

072848

Distribution
Unit Mangers' Meeting: Remedial Action Unit/Source Operable Units
100 and 300 Areas

Mike Thompson........DOE-RL, RP (H0-12)
Glenn Goldberg........DOE-RL, RP (H0-12)
Owen Robertson........DOE-RL, RP (H0-12)
Robert McLeod........DOE-RL, RP (H0-12)
Bryan Foley........DOE-RL, RP (H0-12)
Ellen Mattlin........DOE-RL, EAP (A5-15)

Lisa Treichel........DOE-HQ (EM-442)

Dennis Faulk........100 Aggregate Area Manager, WDOE (B5-01)

Joan Bartz........WDOE (Kennewick) (B5-18)
Phil Staats........WDOE (Kennewick) (B5-18)
David Holland........WDOE (Kennewick) (B5-18)
Shri Mohan........WDOE (Kennewick) (B5-18)
Wayne Soper........WDOE (Kennewick) (B5-18)
Ted Wooley........WDOE (Kennewick) (B5-18)
Alex Stone........WDOE (Kennewick) (B5-18)
Gail Laws........WDOE (Kennewick) (B5-18)

Lynn Albin........Washington Dept. of Health

Jeff James........BHI (L6-06)
Tamen Rodriguez........BHI (H0-17)
Chris Kemp........BHI (S3-20)
Amy Jones........BHI (H0-10)
Michelle Peterson........BHI (H0-10)
Jon Fancher........BHI (H9-02)
Joan Woolard........BHI (H0-02)
Rick Donahoe........BHI (H0-17)
Frank Corpuz........BHI (X9-06)
Rich Carlson........BHI (L6-06)
Alvin Langstaff........BHI (X3-40)
Larry Hulstrom........BHI (H9-03)
Linda Deitz........BHI (H0-20)
Alvina Goforth........BHI (H0-09)
Fred Roeck........BHI (H0-17)
Mark. Sturges........CHI (X3-40)
Dave Blumenkranz........CHI (H9-02)
George Henckel BHI (H0-19)
Phyllis Geiger........BHI (H0-19)

Please inform Tamen Rodriguez (372-9562) – BHI
Of deletions or additions to the distribution list.